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CRYPTOGAMIE

BRYOLOGIE LICHENOLOGIE

TOME 16 FASCICULE 2 1995

CONTENTS

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THE LICHEN GENUS *XANTHORIA* IN ANTARCTICA

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ABSTRACT - Three *Xanthoria* species occur in Antarctica: *X. candelaria* s.str., *X. mawsonii* and *X. elegans*. The genus was treated by previous authors under different generic names: *Blastenia*, *Caloplaca*, *Candelariella*, *Kuttlingeria*, *Polycauliona* and *Xanthoria*. Two new synonyms of *X. elegans* are provided, while five previously proposed synonyms are confirmed by the examination of type specimens. Altogether, eleven taxa described from Antarctica are synonyms of two widespread *Xanthoria* species, *X. candelaria* s. str. and *X. elegans*. *X. mawsonii*, an endemic species, previously considered by most authors as conspecific with *X. candelaria*, proved to be a distinct species, differing from *X. candelaria* s. str. in morphology and in the longer spermatia. The three *Xanthoria* species are keyed and discussed; a comprehensive list of synonyms is provided. *X. elegans* seems to be widespread in all Antarctic regions, *X. candelaria* is reported from subantarctic and maritime regions while *X. mawsoni* seems to be restricted to continental Antarctica.

INTRODUCTION

In the Lichen flora of the Antarctic regions (Dodge 1973) *Teloschistaceae* were treated under two not validly published families, *Blasteniaceae* Dodge & Baker (1938) and *Xanthoriaceae* Dodge (1971), altogether comprising ten genera. Many of the genera adopted by Dodge & Baker (1938) and Dodge (1973) are not accepted by most of the modern authors (Almborn 1963, Kärnefelt 1989): *Blastenia* (Massal.) Trevis. and *Gasparrinia* Tornab. are included in *Caloplaca*; *Polycauliona* Hue comprises subfruticose species belonging to different taxa (Poelt & Pelleter 1984); *Huea* Dodge & Baker includes species with a carbonaceous excipulum and an unpigmentated thallus, showing strong affinities with *Caloplaca* sect. *Pyrenodesmia*; *Kuttlingeria* Trevis. includes species with effigurate thalli and a well-developed lower cortex and according to the description of Dodge & Baker (1938) presumably corresponds to different forms of *Xanthoria elegans* (Kärnefelt 1989); *Mawsonia* Dodge probably includes lichens not belonging to *Teloschistaceae* (Poelt & Hafellner 1980, Kärnefelt 1989); *Lethariopsis* Zahlbr. corresponds to a *Caloplaca* growing on *Neuropogon* (Lamb 1948).

Although *Teloschistaceae* represent a natural taxon, the delimitation among genera is not always clear (Almborn 1963, Poelt & Hafellner 1980, Kärnefelt 1989); within this family the genus *Xanthoria* is characterized by a foliose thallus and a paraplectenchymatous cortex of anticlinal hyphae. *Xanthoria* species were treated by

Dodge (1973) under five different generic names, *Caloplaca*, *Gasparrinia*, *Kuttlingeria*, *Xanthoria* and *Polycauliona* (Filson 1984), mainly distinguished by external morphological features, and included in the *Blasteniaceae* or in the *Xanthoriaceae*.

According to the most recent literature, two species of *Xanthoria* occur with certainty in Antarctica, *X. candelaria* s. lat. and *X. elegans*; both of them are highly variable taxa.

The Antarctic material belonging to *X. candelaria* s.lat. is very polymorphic (Jørgensen 1986): the relations between the two sorediate taxa described from Antarctica, *X. candelaria* f. *antarctica* Hillm. and *X. mawsonii* Dodge, were never completely clarified. According to Poelt & Petutschnig (1992) *X. candelaria* f. *antarctica* Hillm. falls in the variation range of *X. candelaria* s. str. Many authors (Filson 1975, Lindsay 1972, Øvstedal 1983) regarded *X. mawsonii* as a synonym of *X. candelaria*. According to Poelt & Petutschnig (1992), however, two different forms of the *X. candelaria* group occur in Antarctica: one agrees with *X. candelaria* s. str. while the other could correspond to *X. mawsonii*.

The high variability of *X. elegans* induced many authors to describe different morphotypes as new species or genera: according to Filson (1982, 1984), four species belonging to *Gasparrinia* and *Polycauliona*, all endemic to Antarctica, are synonyms of *X. elegans*.

This paper is a contribution to the knowledge of the genus *Xanthoria* in Antarctica, based on the revision of the types of several species described from Antarctica, and on the examination of large collections from different areas of Antarctic and subantarctic regions.

MATERIALS AND METHODS

This paper is based on the revision of type material and specimens of several species cited by Dodge (1973), from FH, PC, TUR, WELT, and on collections from TSB, GZU, KIEL-HA, S.

Anatomical characters were studied by light microscopy on hand-cut sections, mounted in deionized water or dilute KOH solution; all measurements were made in water mounts.

The descriptions of species are based on analysis of the Antarctic material.

KEY TO THE SPECIES

1 Thallus without soredia, blastidia or isidia, placodiomorph, consisting of radiating, more or less contiguous or imbricate lobes; lobes irregularly branched, up to 1 mm wide, convex, attached to the substratum by short white hapters..... ***Xanthoria elegans***
1 Thallus with soredia and blastidia..... **2**

2 Thallus yellow or yellow-orange, foliose or subfruticose, consisting of ascending lobes, up to 5 mm tall and 0.5-1.5 mm wide, more or less crowded in pulvinate clusters

up to 2 cm diam.; lobes irregularly subdivided in elongated and thin lobules; blastidia present along the margins and on the lower surface; apothecia and spermogonia frequent; spermatia broadly ellipsoid, 2-2.5 x 1-1.5 µm. ..... ***X. candelaria***

2 Thallus orange or reddish, foliose to subfruticose, rosette-shaped; lobes plane or convex, horizontal to ascending, 2-5 mm tall and 1-3 mm wide, often with a whitish pruina; terminal parts of the lobes broader, scarcely and irregularly incised; blastidia present on the apical and marginal parts of the lobes, on the lower surface, often forming labriform "soralia"; spermogonia rare; spermatia ellipsoid, 3-4.5 x 0.8-1.2 µm. ..... ***X. mawsonii***

THE SPECIES

Xanthoria elegans (Link) Th. Fr.

Nova Acta Regiae Soc. Sci. Upsal., ser. 3, 3: 69 (1861). Bas.: *Lichen elegans* Link, *Ann. Naturges.* 1: 37 (1791).

Kuttlingeria rufa Dodge & Baker, *Ann. Missouri. Bot. Gard.* 25: 615 (1938); type: Marie Byrd Land, Mt. Woodward, 77°17'S 145°45'W, *P.A. Siple, F.A. Wade, S. Corey & O.D. Stancliff DW-4* (not seen); fide Kärnefelt 1989: 151, 197.

Kuttlingeria rutilans Dodge & Baker, *Ann. Missouri. Bot. Gard.* 25: 616 (1938); type: Marie Byrd Land, Skua Gull Peak, 76°49'S 145°29'W, *P.A. Siple & S. Corey 72W-9* (not seen); fide Kärnefelt 1989: 151, 197.

Polycauliona pulvinata Dodge & Baker, *Ann. Missouri Bot. Gard.* 25: 628 (1938); type: Marie Byrd Land, Edsel Ford Range, Mt. Rea-Cooper, 77°07'S 145°30'W, on coarse-grained leucogranite, *P. Siple, F.A. Wade, S. Corey & O.D. Stancliff R-3* (FH-Dodge! holotype); - *Caloplaca elegans* var. *pulvinata* (Dodge & Baker) Murray, *Trans. Roy. Soc. New Zealand* 2: 64 (1963); fide Filson 1984: 311.

Polycauliona sparsa Dodge & Baker, *Ann. Missouri Bot. Gard.* 25: 629 (1938); type: Marie Byrd Land, Skua Gull Peak, 76°53'S 145°30'W, *P. Siple & S. Corey 72W-5* (not seen); - *Caloplaca sparsa* (Dodge & Baker) Murray, *Trans. Roy. Soc. New Zealand* 2: 65 (1963); fide Filson 1984: 311.

Polycauliona johnstonii Dodge, BANZ. Antarct. Res. Exped. Rep. B, 7: 239 (1948); type: MacRobertson Coast, Cape Bruce, 67°26'S 60°49'E, rocks near shore, *B.A.N.Z.A.R.E. 108-28* (FH-Dodge! holotype); fide Filson 1984: 311.

Caloplaca sparsa var. *latespora* (Dodge & Baker) Murray, *Trans. Roy. Soc. New Zealand* 2: 65 (1963); type: Victoria Land, Football Mountain, 2700 ft, on rock, *Croll & Fitzgerald*, WELT 127 (not seen); fide Filson 1984: 311.

Candelariella rudolphi Dodge, *Trans. Amer. Microscop. Soc.* 84: 520 (1965); type: [Victoria Land] Ross Island, Cape Crozier, 77°29'S 169°34'E, Pat's Peak, on black lava, *E.D. Rudolph 64023* (FH-Dodge! holotype); fide Castello & Nimis 1994b: 9.

New synonyms:

Gasparrinia siplei Dodge & Baker, *Ann. Missouri Bot. Gard.* 25: 624 (1938); type: Marie Byrd Land, Skua Gull Peak, 76°50'S 145°30'W, on dark greenish gray slate, orthoclase-sericite schist, fine-grained dike, 1934, *P.A. Siple, F.A. Wade, S. Corey & O.D. Stancliff 72W-6/7* (FH-Dodge! holotype); - *Xanthoria siplei* (Dodge & Baker) Dodge, Lich. Fl. Antarct. Cont. Isl.: 274 (1973).

Blastenia sparsa Murray, *Trans. Roy. Soc. New Zealand* 2: 63 (1963); type: Victoria Land, Cape Hallett, Tombstone Hill, Hallett Base, 3200'ft, *Fitzgerald & Croll* (WELT 143! holotype).

Thallus crustose to subfoliose, effigurate, orange to reddish, K + red, consisting of radiating, more or less contiguous or overlapping lobes, 0.5-1 mm wide; lobes irregularly branched, up to 1 mm wide, convex, attached to the substratum by short white hapters. Upper cortex 20-30 µm tall, paraplectenchymatous, with an outer layer encrusted with brown-yellowish granules; medulla consisting of loosely interwoven hyphae, 5 µm diam., with a thick wall; lower cortex more or less developed, similar to the upper cortex. **Apothecia** sessile to slightly stalked, concolorous with the thallus, 0.5-2.5 µm diam., often crowded; disc plane and margin persistent, concolorous with the thallus. Epithecium brown-yellowish, granular; hymenium hyaline, 50-80 µm tall; hypothecium hyaline, 20-30 µm tall. Paraphyses septate, branched, 2 µm diam., apices 4-5 µm diam., incrusted with brownish granules. Asci clavate, 50-65 x 12-15 µm, 8-spored. Spores polardiblastic, colourless, ellipsoid, (9-)10-13 x (5-)6-7 µm, septum 3-4 µm. **Spermogonia** immersed in red warts on the upperside of the thallus; spermatia ellipsoid, 3.2-4 x 1.2-1.5 µm.

Discussion. - *X. elegans* is a widespread and highly polymorphic species with a broad ecological amplitude; the variability mainly affects thallus development and colour, growth form and frequency of apothecia (Thompson 1984, Clauzade & Roux 1985, Poelt & Petutschnig 1992). According to Hill & Woolhouse (1966) and Fahselt & Krol (1989) the variability is purely due to environmental factors, such as light intensity and water and nutrient supply, as no substantial biochemical difference was found among different morphotypes.

Many authors who worked on Antarctic material considered morphotypes of *X. elegans* as different species, even placed in different genera, such as *Gasparrinia*, *Kuttlingeria*, *Xanthoria* and *Polycauliona*. These genera mainly differ in morphological traits which are quite unrelevant taxonomically (Filson 1982, 1984).

Five previously proposed synonyms of *X. elegans* were confirmed by investigations of types or material from Dodge's herbarium. The conspecificity of *X. elegans* and *Polycauliona johnstonii*, *P. pulvinata* and *P. sparsa* was proposed by Filson (1984) without the examination of types. We have analyzed the types of *P. johnstonii* and *P. pulvinata*: they consist of thalli with well-developed imbricate lobes, which are more or less ascending and branched; the characters of thalli, apothecia and spores agree with *X. elegans*: *P. johnstonii* and *P. pulvinata* must be considered as morphotypes of this species. The type material of *P. sparsa* was not available, but the specimen *R.G. Frazier & F.A. Wade 317b* from Dodge's herbarium agrees in all characters with *X. elegans*: it consists of small orange thalli with narrow lobes, appressed to the substratum.

Kärnefelt (1989) maintened that, according to the description of Dodge & Baker (1938), *Kuttlingeria rufa* and *K. rutilans* are conspecific with *X. elegans*, but he did not examine the types; types of these species were not available, but all specimens of *K. rufa* and *K. rutilans* from Dodge's herbarium investigated by us belong to *X. elegans*.

Two new synonyms of *X. elegans* are proposed: the type of *Gasparrinia siplei* consists of foliose thalli, with appressed lobes up to 1 mm wide, while the type of *Blastenia sparsa* consists of very small, badly developed, crustose orange thalli, that

show in some parts a whitish lower cortex. The anatomical characters of the thallus, the apothecia and spores of both specimens agree with those of *X. elegans*.

The synonymy of *X. elegans* and *Polycauliona citrina* and *Gasparrinia harrisonii*, proposed by Filson (1984), cannot be mantained any more: examination of type material demonstrated that *P. citrina* is conspecific with *Pleopsidium chlorophanum* (Wahlenb.) Zopf (Castello & Nimis 1994a), while all specimens of *G. harrissonii* in Dodge's herbarium belong to *Caloplaca saxicola* (Hoffm.) Nordin (Søchting, *in litt.*).

X. elegans could be confused with *Caloplaca lucens* (Nyl.) Zahlbr., known from maritime and subantarctic regions (Søchting & Øvstedal 1992).

Distribution. - A cosmopolitan species. *X. elegans* is widespread in continental, maritime and subantarctic regions.

Specimens examined: **Marie Byrd Land:** Skua Gull Peak, 76°50'S 145°30'W, 1934, *P.A. Siple, F.A. Wade, S. Corey & O.D. Stancliff 72W-9* (FH-Dodge), as *G. siplei*; Edsel Ford Range, *J.E. Perkins 146* (B46) (FH-Dodge), as *K. rufa*; Mt. Woodward, *P. Siple, F.A. Wade, S. Corey & O.D. Stancliff DW-2* (FH-Dodge), as *K. rutilans*; Edsel Ford Mts, *J.E. Perkins* 142 (FH-Dodge), as *K. rutilans* - **King Edward VII Land:** Rockefeller Mountains, Mt. Patterson, 18 Dec. 1940, *R.G. Fitzsimmons 280* (FH-Dodge), as *G. siplei*; Rockefeller Mountains, Mt. Patterson, 25 Dec. 1940, *R.G. Fitzsimmons 325* (FH-Dodge), as *G. siplei*; Rockefeller Mountains, Mt. Nielson, Dec. 15 1940, *R.G.Frazier & F.A. Wade 317b* (FH-Dodge), as *P. sparsa* - **Victoria Land:** Terra Nova Bay, Reeves Glacier, Teall Nunatak, *P. Modenesi* (TSB A401); Terra Nova Bay, Reeves Glacier, Tarn Flat, *S. Sedmak* (TSB A180, A188, A299); Wood Bay, Kay Island, *G. del Frate* (TSB A115); Hallett Peninsula, *E.D. Rudolph* 61050 (FH-Dodge), as *K. rufa*; Mt. Suess, Gondola Ridge, *J. Mulligan 9, 10* (FH-Dodge), as *K. rufa*; Cape Hallett Station, *G.A. Llano 2729* (FH-Dodge), as *K. rutilans*; Ross Island, Hut Point Peninsula, ca 77°51'S 166°35'E, 26 Jan. 1956, *C.R. Lewis HP-12, HP-14* (FH-Dodge), as *P. pulvinata*; Ross Island, Cape Crozier, 77°29'S 169°34'E, Dec. 9, 1959, *O. Holm-Hansen 12-1, 12-2* (FH-Dodge), as *P. pulvinata*; Ross Island, Cape Crozier, 77°29'S 169°34'E, 25 Jan. 1962, *E.D. Rudolph 62017* (FH-Dodge), as *P. pulvinata* - **Wilkes Land:** Knox Coast, E.A. Midgley 80 (FH-Dodge), as *K. rutilans* - **Mac Robertson Land**: Mawson, lichen type B, R.O. Summers (FH-Dodge), as *P. johnstonii* - **Prince Olav Coast**: Showa, 69°00'S 39°35'E, Japanese Antarctic Exp., 1957-8, *32a* (FH-Dodge), as *P. johnstonii* - **Princess Ragnhild Coast**: Vengen Spur, 72°04'S 23°40'E, 1966, T. van Autenboer 5 (FH-Dodge), as *P. johnstonii*.

Xanthoria candelaria (L.) Th. Fr.

Genera Heterolich. Eur. Recogn.: 61 (1861). Bas.: *Lichen candelarius* L., Sp. Pl.: 1141 (1753).

Xanthoria lychnea f. *antarctica* Vainio, Exped. Antarct. Belge Rés. Voy. S.Y. Belgica Bot.: 22 (1903); type: Exped. Antarc. Belge 167, Détroit de Gerlache, sur les roches humides, Cap van Beneden, Terre de Danco, 67°41'S (11^{e} débarquement) 1898 (TUR Hb. Vainio 07022! holotype); - *Xanthoria candelaria* f. *antarctica* (Vainio) Hillmann, *Hedwigia* 63: 202 (1922); - *Xanthoria antarctica* (Vainio) Dodge & Baker, *Ann. Missouri. Bot. Gard.* 25: 624 (1938); - *Polycauliona antarctica* (Vainio) Dodge, Lich. Fl. Antarct. Cont. Isl.: 276 (1973); fide Poelt & Petutschnig 1992: 19.

Polycauliona coralligera Hue, 1er Exped. Antarct. Franç. Lich.: 10 (1908); type: Booth Island, 65°05'S 64°00'W, *L. Gain 277, 299* (PC! holotype); - *Caloplaca coralligera* (Hue) Zahlbruckner, Cat. Lich. Univ. 7: 274 (1931); - *Thamnoma coralligera* (Hue) Gyeln., *Acta Fauna Fl. Universali., Ser. 2, Bot.* 1 (5-6): 9 (1933); fide Lamb 1948: 250.

Thallus yellow or yellow-orange, K + red, foliose or subfruticose, irregular to rosette-shaped, consisting of ascending lobes, up to 5 mm tall and 0.5-1.5 mm wide, more or less crowded in pulvinate clusters up to 2 cm diam.; lobes irregularly subdivided in elongated and thin lobules; blastidia present along the margins and on the lower surface; underside white, with thin veins and rare whitish hapters. Upper cortex paraplectenchymatous, consisting of more or less isodiametric "cells", 6-7 µm diam., 20-30 µm tall, outer layer with yellow brown granules; medulla consisting of loosely interwoven hyphae, 3-4 µm diam. with a thick wall; lower cortex similar to the upper cortex. **Apothecia** sessile or substipitate, up to 2 µm diam.; margin concolorous with the thallus, disc plane, darker than the thallus. Epithecium brown-yellowish, granular; hymenium and hypothecium hyaline. Paraphyses simple or branched, 2 µm diam., with swollen apices, 4-5 µm diam., incrusted with brownish granules. Asci clavate, 45-50 x 10-12 µm, 8-spored. Spores polarbilocular, colourless, ellipsoid, 11-13 x (5-)6-7(-8) mm; septum 4-5 µm. **Spermogonia** immersed in small orange or reddish warts on the upperside of the thallus; spermatia large ellipsoid, 2-2.5 x 1-1.5 µm.

Discussion. - The *X. candelaria* group in Eurasia was recently revised by Poelt & Petutschnig (1992) and includes five species. *X. candelaria* differs from other European sorediate *Xanthoria* species in the broadly ellipsoid spermatia, 2.3-3 x 1-1.3 µm, while the other species have longer spermatia, up to 4-4.2 µm long. Specimens of the *X. candelaria* complex from King George Island, South Shetland Island (KIEL-HA), revised and cited by Poelt & Petutschnig (1992), and from Tierra del Fuego, Argentina (TSB), agree in all characters with *X. candelaria* s. str.

The types of *X. candelaria* f. *antarctica* and *Polycauliona coralligera* were investigated: although the specimens are sterile and do not bear well-developed spermogonia, they fall in the variation range of *X. candelaria* s. str., as previously stated by Lamb (1948) and Poelt & Petutschnig (1992).

All specimens from Victoria Land and other areas of continental Antarctica investigated by us differ from *X. candelaria* s. str. in morphological and anatomical characters: we regard them as belonging to *X. mawsonii*. It is likely that *X. candelaria*, at present only known for the maritime Antarctic, is replaced by *X. mawsonii* in continental regions.

Distribution. - The name *X. candelaria* was so far used to indicate a complex of different species (Poelt & Petutschnig 1992). *X. candelaria* s. str. is known with certainty from Europe, the Himalayan region and the maritime Antarctic (Poelt & Petutschnig 1992). Our reports extend its distribution to the southernmost part of South America.

Specimens examined: Argentina: Tierra del Fuego, Parque Nacional, Bahia Ensenada, *P. L. Nimis* (TSB 10689); Tierra del Fuego, Parque Nacional, Archipelago de los Cormoranes, *P. L. Nimis* (TSB 10377); Tierra del Fuego, road to Estancia Haberton, West coast, *P. L. Nimis* (TSB 10705) - **South Shetland Islands:** King George Island, Filder Peninsula, *L. Kappen* (KIEL-HA A601, A602).

Xanthoria mawsonii Dodge

BANZ. Antarct. Res. Exped. Rep. B, 7: 236 (1948); type: George V Land, Cape Denison, 67°00'S, 142°36'E, Winter Quarters, *A.A.E. 38* (FH-Dodge! holotype).

Fig.1 - *Xanthoria mawsonii* (TSB A397). Scale 1 mm.

Thallus (Fig. 1) orange or reddish, rosette-shaped, up to 1-1.5 cm diam., often confluent with other thalli, K+ red; lobes plane or convex, horizontal to ascending, 2-5 mm tall and 1-3 mm wide, often with a whitish pruina; terminal parts of the lobes wide, scarcely to irregularly incised; blastidia yellow or orange yellow, present on the apical and marginal parts of the lobes, on the lower surface, often forming labriform "soralia"; underside yellowish to orange-yellowish, with thin veins and sparse whitish hapters. Upperside paraplectenchymatous, 30-40 µm tall, consisting of isodiametric "cells", 6-7 µm diam., upper layer with brown yellowish granules; medulla consisting of loosely interwoven hyphae, 4-5 mm diam., with a thick wall; lower cortex 30-40 µm tall, similar to the upper cortex. **Apothecia**: not seen. **Spermogonia** rare, immersed in small orange or reddish warts on the upperside of the thallus; spermatia ellipsoid, 3-4.5 x 0.8-1.2 µm.

Discussion. - Many authors (Filson 1975, Lindsay 1972, Øvstedal 1983, Jørgensen 1986) consider *X. mawsonii* as a simple modification of *X. candelaria*, but this hypothesis was never confirmed by the examination of the type material of *X. mawsonii*. The conspecificity between these two species cannot be accepted any more after the revision of the *X. candelaria* group by Poelt & Petutschnig (1992): according to the description, *X. mawsonii* should have ellipsoid spermatia, 4 x 0.3 µm, which are very different from those of *X. candelaria* s. str. According to Poelt & Petutschnig (1992), two forms belonging to the *X. candelaria* group occur in Antarctica: one form, with well-developed apothecia and spermogonia and short spermatia, agrees in all characters with *X. candelaria* s. str., while the other could correspond to *X. mawsonii*;

these authors, however, were not able to study material with mature apothecia and spermogonia of the latter form, nor the type material of *X. mawsonii*.

The type of *X. mawsonii* was investigated by us: it consists of several sterile, well-developed orange thalli, with ascending lobes, up to 5 mm long and 0.5-3 mm wide; the edges of the lobes are weakly to deeply incised. Few lobes have red points on the upperside, but no mature spermogonia were found; the characters of spermogonia and spermatia reported in the original description were based on a specimen collected in Victoria Land, Cape Hallett. We were not able to examine this specimen.

Several specimens collected from different areas of continental Antarctica have mature spermogonia with ellipsoid spermatia; these specimens differ from *X. candelaria* s. str. both in external morphology and anatomical characters, having spermatia measuring 3-4.5 x 0.8-1.2 µm: this material agrees in all essential characters with *X. mawsonii*.

Compared with *X. candelaria*, the thalli of *X. mawsonii* are more reddish in colour, the lobes are smaller and wider, and are often whitish-pruinose and less incised; the lobes are ascending and curving upward, often forming lip-shaped or labriform "soralia". Specimens with intermediate morphological features can be found, and it is sometimes difficult to distinguish *X. candelaria* and *X. mawsonii* because of the rarity of spermogonia in the latter species, spermatia being the most reliable character for separating the two taxa. The type material of *X. mawsonii* itself is an intermediate form, and is not much representative of the species.

As far known, *X. mawsonii* seems to be restricted to continental Antarctica: specimens collected in the maritime Antarctic should be carefully studied, as in this region the species could occur together with *X. candelaria*.

X. mawsonii seems to be closely related with *X. borealis* R. Santesson & Poelt, an ornitocoprophilous species known from arctic and subarctic regions (Poelt & Petutschnig 1992). The two species differ only in minor morphological features, *X. borealis* having more convex and recurved lobes; however, it seems wiser to keep the two species separated, at least until fertile material of *X. mawsonii* can be examined.

Distribution. - This species was often treated as *X. candelaria*. As far known, *X. mawsonii* is common in Victoria Land, Wilkes Land and Dronning Maud Land (Antarctic Continent). It is likely that *X. mawsonii* is a widespread circum-antarctic species, replacing *X. candelaria* s. str. in continental Antarctica.

Specimens examined: Victoria Land: Coulman Island, Cape King, *S. Sedmak* (TSB A262, A414); Terra Nova Bay, Northern Foothills, Terra Nova Bay Station, *P. Modenesi* (TSB A396); Wood Bay, Kay Island, *P. Modenesi* (TSB A398, A458); Wood Bay, Mt. Melbourne, Edmonson Point, *P. Modenesi* (TSB A397); Relief Inlet, Prior Island, *S. Sedmak* (TSB A273); Birthday Ridge, *L. Kappen* (KIEL-HA A207) - **Wilkes Land:** Knox Coast, Mitchell Island, 66°20'S 110°30'E, 20 Jan. 1958, *G.A. Llano 2964* (FH-Dodge); Clarke Peninsula, *L. Kappen* (KIEL-HA A1491, A1498); Bunger Hills, 66°18'S 100°45'E, *M. Andreev* (GZU 42-93) - **Mac Robertson Land:** Mawson Rock, East Bay, *R. Filson 14993*, Lich. Antarct. Exsiccati I, n° 24 (BM) - **Dronning Maud Land:** Heimefrontfjella, Sivorgfjella, 74°33'S 11°15'W, *G. Thor 10543, 10547* (S).

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Source : MNHN, Paris

CALOPLACA NAVASIANA NAV.-ROS. ET ROUX SP. NOV., ESPÈCE NOUVELLE DE LICHEN DU LITTORAL MÉDITERRANÉEN

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RÉSUMÉ - Description de *Caloplaca navasiana* Nav.-Ros. et Roux sp. nov., lichen saxicole-calcicole du littoral méditerranéen. Par sa morphologie externe, il rappelle les formes à thalle réduit de *C. velana* (Massal.) Du Rietz, mais en diffère nettement par son thalle presque toujours dépourvu d'anthraquinones, généralement blanchâtre, par ses spores nettement plus allongées et par son écologie. Par ses spores, il se rapproche davantage de *C. saxicola* (Hoffm.) Nordin, mais s'en distingue aisément par son thalle endo- ou hémiendolithique, presque toujours dépourvu d'anthraquinones, jamais lobé, et par son écologie.

RESUMEN - Descripción de *Caloplaca navasiana* Nav.-Ros. et Roux sp. nov., un liquen saxícolo-calcícola del litoral mediterraneo. Por su morfología externa recuerda las formas de talo reducido de *C. velana* (Massal.) Du Rietz, pero se diferencia de esta última por su talo casi siempre desprovisto de antraquinonas, blanquecino, por sus esporas marcadamente más alargadas, con el engrosamiento ecuatorial más largo, y por su ecología. Por sus esporas, se aproxima más a *C. saxicola* (Hoffm.) Nordin, pero de ésta difiere claramente por presentar el talo endo- o hemiendolítico, casi siempre sin antraquinonas, nunca lobulado, y por su ecología.

RESUMO - Priskribo de *Caloplaca navasiana* Nav.-Ros. et Roux sp. nov., petrologa kalkeja likeno de la mediteranea marbordo. Pro ekstera morfologio, gi memorigas la maldiktalajn formojn de *C. velana* (Massal.) Du Rietz, sed diferencas de tiu ci pro talo preskau ciam senantrakinona, generale blanketa, pro sporoj notinde pli longformaj kaj ekologio. Pro sporoj, gi pli afinas al *C. saxicola* (Hoffm.) Nordin, sed facile distingeblas de tiu gi pro talo en- au duon-enpetra, preskau ciam senantrakinona, neniam loba, kaj ekologio.

INTRODUCTION

Lors de recherches sur la flore et la végétation lichéniques du littoral calcaire atlantique méridional et méditerranéen, du Portugal à Chypre (Houmeau et Roux 1984, Navarro-Rosinés et Roux 1992, 1993 et 1994, Roux et Navarro-Rosinés 1992), nous avons montré que le genre *Caloplaca* joue un grand rôle dans les peuplements lichéniques adlittoraux et décrit quatre espèces nouvelles (*C. aquensis* Houmeau et Roux, *C.*

egeana Roux et Nav.-Ros., *C. tavaresiana* Nav.-Ros. et Roux et *C. veneris* Roux et Nav.-Ros.). Dans ces peuplements adlittoraux, on rencontre fréquemment une cinquième espèce de *Caloplaca*, que nous avons désignée dans ces publications sous le nom provisoire de *C. navasiana*.

N'ayant pas pu trouver trace de cette espèce dans la littérature lichénologique, en particulier dans les flores de Clauzade et Roux (1985, 1987, 1989) et de Poelt (1969), nous la décrivons ci-après comme nouvelle et la dédions à Longí Navàs, naturaliste (1858-1939) catalan, qui fut le premier à étudier la flore des lichens de Catalogne méridionale.

DESCRIPTION

I - Morphologie du thalle

Thalle crustacé, endolithique, non ou à peine distinct, ou en partie épilithique et alors mince, fendillé ou même par endroits fendillé-aréolé (aréoles de 0,1-5 mm), parfois aussi réduit à quelques granules entre les apothécies, blanchâtre, parfois plus ou moins ocracé ou encore gris blanchâtre par suite de la présence de cyanobactéries épiphytiques, K -, rarement à peine teinté d'orangé et légèrement K + (pourpre). Algue protococcoïde, à cellules de 8-17(20) µm de diamètre.

II - Apothécies

A. Morphologie externe

Apothécies de (0,1)0,2-0,5(1,5) mm de diamètre, généralement nombreuses, dispersées ou groupées, par endroits denses ou même contiguës, orangées, K+ (pourpre), arrondies mais parfois déformées par compression mutuelle, d'abord enfoncées dans le thalle mais devenant rapidement planes.

Disque orangé, finement rugueux au début, concave puis rapidement plan, parfois légèrement pruineux.

Rebord de 0,02-0,05(0,07) mm d'épaisseur, concolore au disque, lisse, entier, seulement au début assez épais et saillant, mais devenant rapidement mince et à peu près de niveau avec le disque.

B. Structure (fig. 1-2)

Épithécium d'un jaune brunâtre, K+ (pourpre), à surface inégale, d'environ 10 µm d'épaisseur.

Hyménium de 60-80 µm de hauteur, hyalin.

Subhyménium et **hypothécium** assez distincts l'un de l'autre, hyalins, le premier épais, riche en gouttelettes lipidiques (inspergé), le second mince, en continuité avec le parathécium, prosoplectenchymateux, à cellules allongées, à lumière de 1-4 µm de diamètre.

Parathécium (fig. 2) relativement mince (30-50 µm), à partie externe paraplectenchymateuse et à partie interne prosoplectenchymateuse, de même structure que l'hypothécium, à hyphes assez peu distinctement rayonnantes.

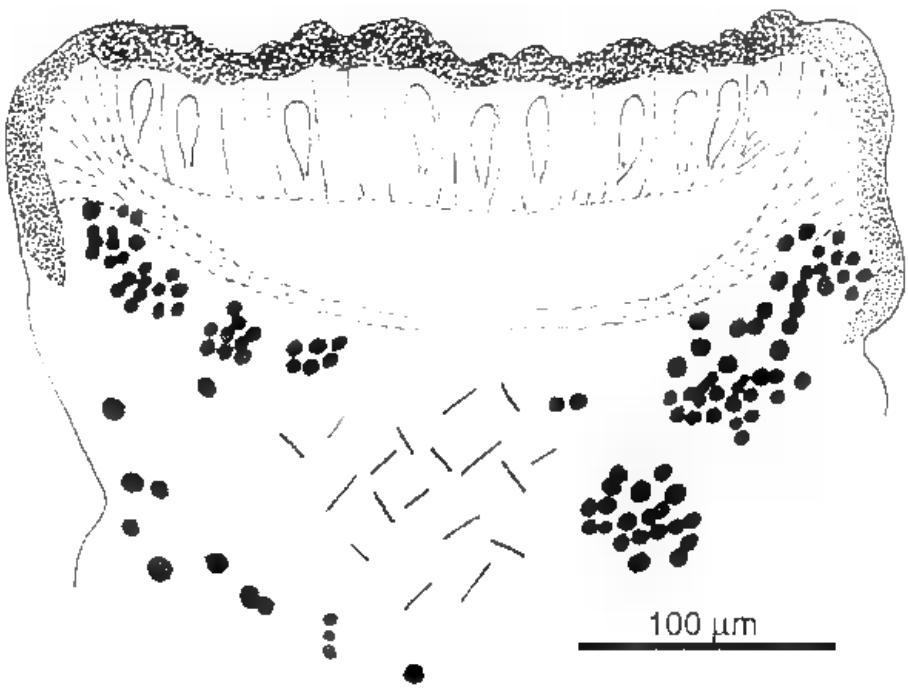

Fig. 1 - Structure microscopique de l'apothécie de *Caloplaca navasiana*, d'après une coupe radiale observée dans l'eau.

Amphithécium réduit à la partie inférieure de l'apothécie, riche en cellules algales.

C. Paraphyses (fig. 3)

Paraphyses distinctement cloisonnées, non ramifiées ou ramifiées une seule fois au sommet, de 1,5-2 µm d'épaisseur à la base et de 3-6 µm au sommet, à 1-2 cellules terminales recouvertes de granules cristallins anthraquinoniques, K+ (pourpre).

D. Asques (fig. 4)

Asques claviformes, typiques de la famille des *Teloschistaceae*, octosporés, plus rarement hexa- ou tétrasporés, de 39-46 x 12-17 µm.

E. Ascospores (fig. 5 et tab. 1)

Ascospores hyalines, ellipsoidales, de (9)10-11,7-13(14,5) x 4-5,2-6(7) µm, à rapport longueur sur largeur de (1,8)1,9-2,3-2,7(3,5), polariloculaires, à épaississement équatorial ("septum") de (3,5)4,5-5,4-6(9) µm de longueur, occupant environ la moitié de la longueur de la spore (d'après 95 mesures).

DIAGNOSE

En latin: *Caloplaca navasiana* Nav.-Ros. et Roux sp. nov.

Thallus crustaceus, endolithicus aut parum epilithicus, parum vel non distinctus, albidus vel ochraceus, K -. Alga protococcoidea, cum cellulis 8-17(20) µm. Apothecia

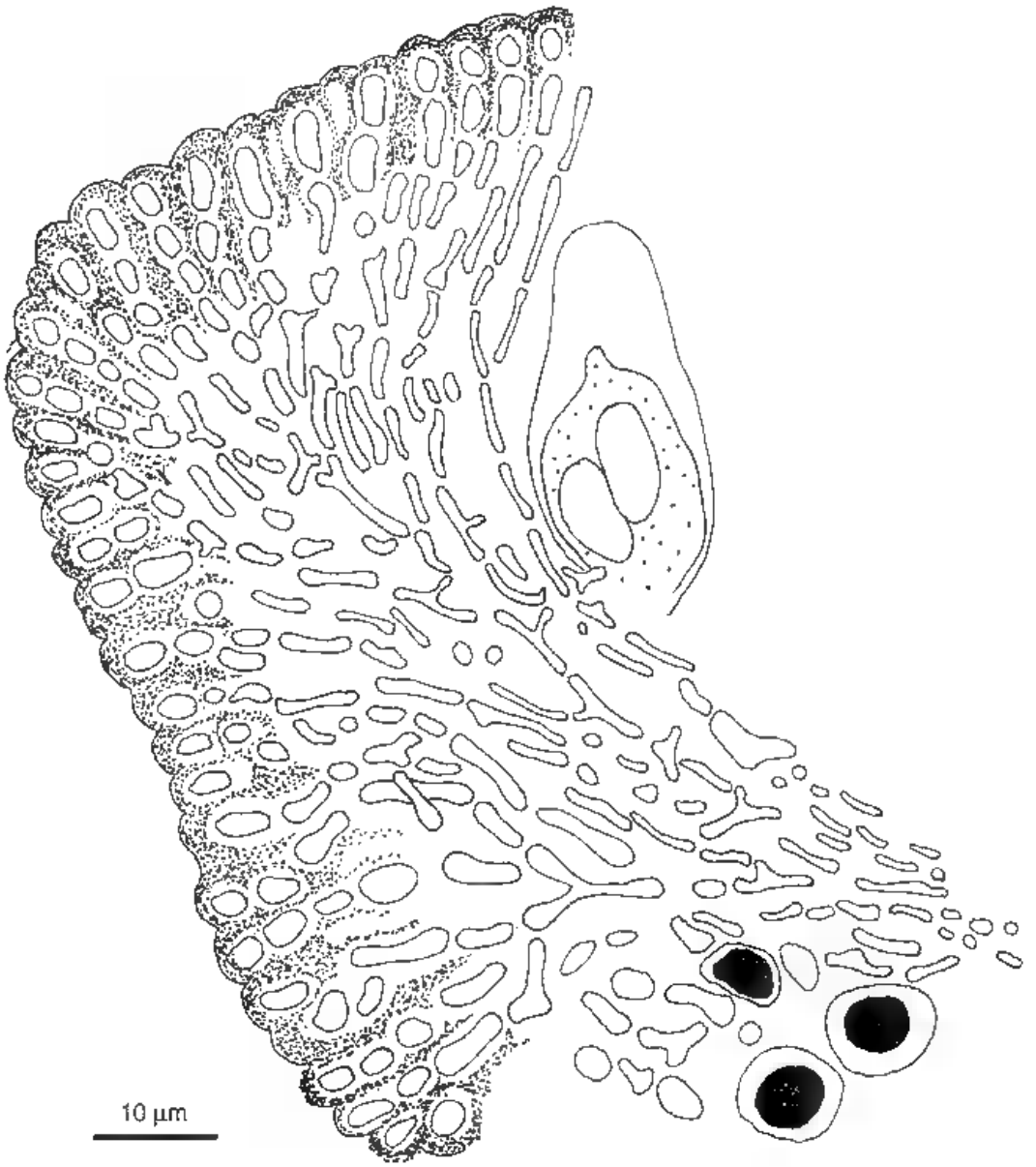

Fig. 2. - Structure microscopique du parathécium de l'apothécie de *Caloplaca navasiana*, d'après une coupe radiale colorée au bleu de lactophénol.

(0,1)0,2-0,5(1,5) mm, aurantia, K+ (purpureum), primum in thallo immersa, deinde sessilia; discus primum concavus, deinde planus; margo concolor disco, primum crassa et eminens, deinde tenuis et parum eminens. Epithecium bruneum aurantiacum, K+ (purpureum). Hymenium 60-80 µm altum. Subhymenium et hypothecium sine colore. Parathecium cum cortice epithecio simili et medula sine colore, in externa parte paraplectenchymaticum et in interna prosoplectenchymaticum, non clare distincte radiantibus hyphis constitutum. Amphithecium in inferiore apothecii parte minutum, cum abundantibus algae cellulis. Paraphyses clare septatae, non aut tantum in summa parte ramosae,

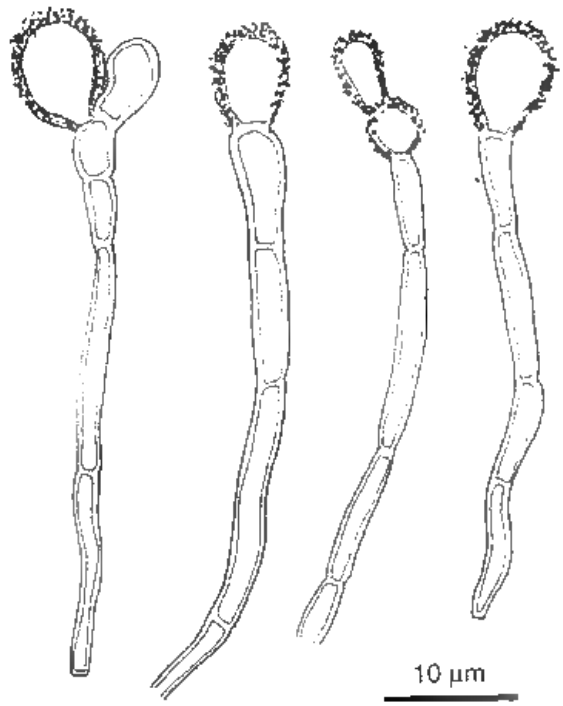

Fig. 3. - Paraphyses de *Caloplaca navasiana*, observées dans l'eau.

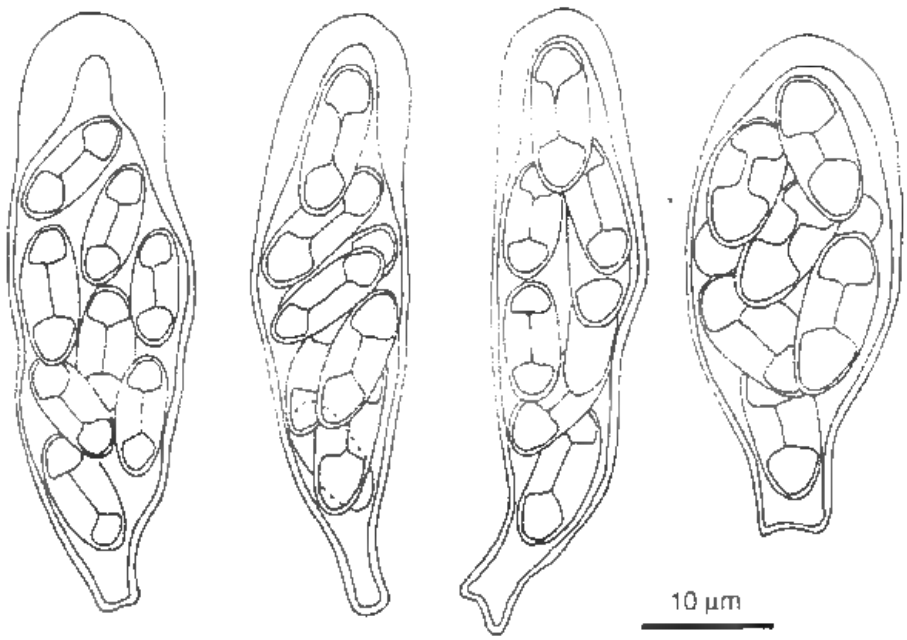

Fig. 4 - Asques octosporés de *Caloplaca navasiana*, observés dans l'eau.

	Longueur L	Largeur l	Rapport L/l	Longueur de l'épaississemen équatorial (Le)	Rapport Le/L
Effectif	95	95	95	95	95
Valeur min.	9	4	1,8	3,5	0,3
1° décile	**10**	**4**	**1,9**	**4**	**0,4**
Moyenne	11,7	5,2	2,3	5,4	0,46
9° décile	**13**	**6**	**2,7**	**6**	**0,5**
Valeur max.	14,5	7	3,5	9	0,9
Ecart-type	1,2	0,6	0,32	0,9	0,1
Erreur standard	0,1	0,1	0,03	0,1	0,01

Tableau I - Dimensions des spores de *Caloplaca navasiana* d'après des spécimens de Catalogne et de Chypre.

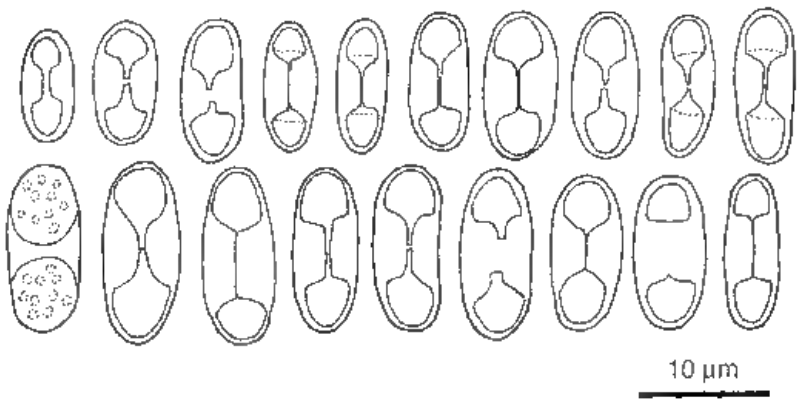

Fig. 5 - Ascospores polariloculaires de *Caloplaca navasiana*, mortes, observées dans l'eau.

cum base 1,5-2 µm et summa parte 3-6 µm µm crassa. Asci (39-46 x 12-17 µm) typo familiae Teloschistaceae, octospori, rari hexa- aut tetraspori. Ascosporae polariloculares, hyalinae, longe ellipsoideae, (9)10-13(14,5) x 4-6(7) µm, cum media densatione (3,5)4-5,2-6(9) µm longa.

Typus: Hispania, Catalonia, provincia Tarragona, municipium Vilaseca i Salou, loco dictu Cala Font, U.T.M. 31TCF4546, 20 m alt., supra saxa calcarea crescens, ad maris litoris, 1987.10.20, *leg. N.L. Hladun et P. Navarro-Rosinés*.

Holotypus en BCC-lich. herbarium ; **isotypi** en MARSSJ herbarium, et en BCC-lich. herbarium.

En langue internationale (espéranto) *Caloplaca navasiana* Nav.-Ros. et Roux sp. nov.

Talo krusteca, enpetra aù maldike surpetra, ne aù ne tre videbla, blanketa aù okreta, K -. Algo protokokoida, kun cheloj 8-17(20) µm. Apotecioj (0,1)0,2-0,5(1,5) mm, multaj, oranghaj, K+ (purpuraj), unue entalaj, kun disko unue konkava, poste ebena, kun randajho maldika, ne elstara. Epitecio brune flava, K+ (purpura). Himenio senkolora, 60-80 µm alta. Subhimenio k hipotecio senkoloraj, apenaù interdistingeblaj. Paratecio kun kortiko epitecieca, K + (purpura) k medolo senkolora, diketa, ekstere paraplektenkima, interne prozoplektenkima, el hifoj ne klare radiantaj. Amfitecio malvasta, nur subaparte de la apotecio, kun multaj algocheloj. Parafizoj distingeble septaj, ne aù nur chesupre furkaj, chebaze 1,5-2 µm dikaj, chesupre 3-6 µm dikaj. Askoj (39-46 x 12-17 µm) 8-sporaj, malofte 4- aù 6-sporaj. Askosporoj polusochelaj, senkoloraj, longe elipsoidaj, (9)10-13(14,5) x 4-6(9) µm, kun dikajho (3,5)4-5,2-6(9) µm longa.

Tipoj: Hispanio, Katalunio, provinco Tarragona, komunumo Vila-seca i Salou, loko Cala Font, U.T.M. 31TCF4546, 20 m, sur kalkaj rokoj apudmaraj, 1987.10.20, *leg. N.L. Hladun k P. Navarro-Rosinés.*

Holotipo en BCC-lich. herbario; **izotipoj** en MARSSJ herbario kaj en BCC-lich. herbario.

AFFINITÉS

Par ses apothécies orangées dépourvues de bord thallin, ses paraphyses simples, nettement renflées au sommet, *C. navasiana* rappelle *C. velana* (Massal.) Du Rietz, plus particulièrement certaines formes désignées par Ozenda et Clauzade (1970) sous le nom de *Caloplaca schaereri* (Flörke) Zahlbr., qui présentent un thalle très réduit. Elles se distinguent cependant de *C. navasiana* par des spores moins allongées ainsi que par un thalle toujours riche en anthraquinone.

C. navasiana se rapproche également de *C. saxicola* par des spores ellipsoïdales allongées, à rapport longueur sur largeur supérieur à 2, à épaississement équatorial à longueur d'environ la moitié de la longueur totale de la spore, ainsi que par ses paraphyses simples, à sommet renflé. Mais il s'en distingue aisément par un thalle très réduit, endo- ou hémiendolithique, jamais lobé à la périphérie, généralement blanchâtre et dépourvu d'anthraquinones, ainsi que par des spores un peu plus petites.

RÉPARTITION ET ÉCOLOGIE

Nous avons découvert *Caloplaca navasiana* dans la Péninsule Ibérique depuis plusieurs années et l'avons trouvé plus récemment en Grèce (1989), à Chypre (1991) et dans le sud de la France (1993).

Il se rencontre exclusivement sur le littoral méditerranéen, à l'étage adlittoral, sur des roches calcaires. Avec trois autres *Caloplaca*, *C. aquensis* Houmeau et Roux, *C. tavaresiana* Nav.-Ros. et Roux et *C. veneris* Roux et Nav.-Ros. (Houmeau et Roux 1984, Navarro-Rosinés et Roux 1993, et Roux et Navarro-Rosinés 1992), il appartient à une

association, le *Caloplacetum tavaresianae* Roux et Nav.-Ros. (Navarro-Rosinés et Roux 1994), qui se rencontre dans le même étage que l'*Opegraphetum durieui* Egea et Roux (Roux et Egea 1992), mais sur des surfaces horizontales ou modérément inclinées, ensoleillées ou au moins bien éclairées, normalement mouillées par les pluies, moyennement riches en nitrates.

SPÉCIMENS EXAMINÉS

Portugal: Algarve, Peniche, cap Carvoeiro, 300 m au S du phare, sur paroi de calcaire très cohérent et compact, 10 m, 06.IV.1990, leg. J. M. Egea et C. Roux (MARSSJ).

Espagne: • Baléares -Illa de Formentera: Trucadors, 28.XII.1967, leg. X. Llimona (BCC-lich. 231). Avec *Caloplaca flavescens* (Huds.) Laund. et *C. tavaresiana* Nav.-Ros. et Roux. • **Catalogne** - Prov. de Barcelona, Baix Penedès, Sitges: Cala de les Coves, 30 m, 9.VII.1992, *leg. X. Llimona, P. Navarro-Rosinés et C. Roux* (BCC-lich., MARSSJ); Prov. de Tarragona, Tarragonès, Roda de Berà: Roc de Berà o de St. Gaietà, U.T.M. 31TCF7258, 10 m, 25.IV.1986, *leg. N.L. Hladun, X. Llimona et P. Navarro-Rosinès* (BCC-lich.); Prov. de Tarragona, Tarragonès, Tarragona: Punta Grossa, U.T.M. 31TCF5453-CF5553, 6 m, 20.X.1987, *leg. N.L. Hladun et P. Navarro-Rosinés* (BCC-lich.); Prov. de Tarragona, Tarragonès, Tarragona: Punta de la Creueta, U.T.M. 31TCF5954-CF6054, 3-25 m, 20.II.1987, *leg. M. Giralt, A. Gómez-Bolea et P. Navarro-Rosinés* (BCC-lich.).- Ibid., 10.VII.1992, *leg. X. Llimona, P. Navarro-Rosinés et C. Roux* (BCC-lich., MARSSJ); Prov. de Tarragona, Tarragonès, Tarragona: Punta de la Rabassada, U.T.M. 31TCF5553, 5 m, 20.X.1987, *leg. N.L. Hladun et P. Navarro-Rosinés* (BCC-lich.); Prov. de Tarragona, Tarragonès, Vila-seca i Salou: interior de Cap de Salou, U.T.M. 31TCF4647, 30 m, 25.IV.1986, *leg. N.L. Hladun, X. Llimona et P. Navarro-Rosinés* (BCC-lich.); Prov. de Tarragona, Tarragonès, Vila-seca i Salou: Punta del Far (Cap de Salou), U.T.M. 31TCF4646, 20 m, 20.X.1987, *leg. N.L. Hladun et P. Navarro-Rosinés* (BCC-lich.); Prov. de Tarragona, Tarragonès, Vila-seca i Salou: Punta del Racó (Cap de Salou), U.T.M. 31TCF4747, 3-10 m, 25.IV.1986, *leg. N.L. Hladun, X. Llimona et P. Navarro-Rosinés* (BCC-lich.); Ibid., 20.X.1987, *leg. N.L. Hladun et P. Navarro-Rosinés* (BCC-lich.); Ibid., 10.VII.1992, *leg. X. Llimona, P. Navarro-Rosinés et C. Roux* (BCC-lich., MARSSJ). • **Murcia** - Mazarrón: Calas de Punta Bela, 20 m, 22.III.1987, *leg. J.M. Egea, P.P. Moreno et L. Alonso* (MUB); Ibid., 1.X.1992, *leg. L. Alonso, J.M. Egea, P. Navarro-Rosinés et C. Roux* (BCC-lich., MARSSJ). • **País Valencià** - Prov. d'Alacant, Marina Alta, Xàbia: platja de la Granadella 0-10 m, 2.V.1986, *leg. L. Aparicio et J.M. Egea* (MUB); Prov. d'Alacant, Oriola: Cap Roig, 5 m, 1.X.1992, *leg. L. Alonso, J.M. Egea, P. Navarro-Rosinés et C. Roux* (BCC-lich., MARSSJ); Prov. d'Alacant, Torrevieja: Cap Cervera, 5 m, 1.X.1992, *leg. L. Alonso, J. M. Egea, P. Navarro-Rosinés et C. Roux* (BCC-lich., MARSSJ); Prov. de Castelló, Plana Alta, Oropesa: Cap d'Oropesa, U.T.M. 30TBF6541-BF5741, 2-5 m, 14.XI.1987, *leg. N.L. Hladun* (BCC-lich.).

France: Aude, Narbonne, La Clape, 4.VIII.1974, *leg. G. Clauzade* (BCC-lich. 1253) - Bouches-du-Rhône, Marseille, calanque de Sormiou, 5 m, 9.V.1993, *leg. C. Roux et P. Navarro-Rosinés* (MARSSJ, BCC-lich); Marseille, cap Morgiou, 5 m, 9.V.1993, *leg. C. Roux et P. Navarro-Rosinés* (MARSSJ, BCC-lich.).

Grèce: SE de Athènes, Fokea, entre Fokea et Laguna, sur une falaise adlittorale de calcaire très cohérent et compact, 5 m, 23.IX.1989, *leg. C. Roux* (MARSSJ).

Croatie: Dalmatien, auf Kalkfelsen in der Spritzzone an der Küste der Insel Korcula unweit des Hotels "Bon Repos", südlich der Stadt Korcula, 31.VIII.1969, *leg. J. Poelt* (GZU, Herb. J. Poelt 7430: cum *C. aurantia*).

Italie: Sardinien, prov. Cagliari, Felsküste ca. 1,5 km N von Buggerru, ca. 30-50 m alt., Kalk, 2.V.1986, *leg. H. Mayrhofer* 6028 (GZU) - Sicilia, Isole Pelagie, Lampedusa, presso Capo Gregale, rocce calcaree verticali esposte a nord, ca. 80 m, 11.IV.1992, *leg. J. Poelt* (GZU); Isole Pelagie, Lampedusa, Punta occidentale dell'Isola, tra Punta Parise, Capo Ponente e C. Teresa, 80-100 m, 13.IV.1992, *leg. J. Poelt* (GZU).

Chypre: E de Xylophaghou, entre les caps Pyla et Greco, sur des blocs de calcaire un peu gréseux à quelques m du bord de mer, 3 m, 12.IV.1991. *leg. C. Roux* (MARSSJ).

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Source : MNHN, Paris

HONGOS LIQUENÍCOLAS DE *SQUAMARINA* II*: SOBRE LA IDENTIDAD *DE "DIDYMELLA" CROZALSIANA* (ASCOMYCETES)

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RESUMEN - *Cercidospora crozalsiana* (Oliv.) Nav.-Ros., Roux et Casares comb. nov. [= *Didymella crozalsiana* (Oliv.) Vouaux], un hongo liquenícola no liquenizado poco citado, que crece como parasimbionte de diferentes especies de *Squamarina*, es descrita y comentada. Por sus características morfológicas, *C. crozalsiana* es próxima a *C. ulothii* Körber, un hongo parasimbionte específico de *Lecanora* gr. *muralis*, pero se diferencia de ésta por el mayor tamaño de sus estructuras, en especial por las dimensiones de las esporas.

RESUMO - Komentita priskribo de *Cercidospora crozalsiana* (Oliv.) Nav.-Ros., Roux et Casares comb. nov. [= *Didymella crozalsiana* (Oliv.) Vouaux], nelikenighinta fungo likenlogha malofte menciita, parasimbioza al diversaj specioj de *Squamarina*. *C. crozalsiana* laŭmorfologie afinas al *C. ulothii* Körber, likenlogha fungo parasimbioza al la specioj de la grupo de *Lecanora muralis*, sed bone diferencas de tiu specio pro pli grandaj askomoj, askoj, kaj chefe sporoj.

RÉSUMÉ - *Cercidospora crozalsiana* (Oliv.) Nav.-Ros., Roux et Casares comb. nov. [= *Didymella crozalsiiana* (Oliv.) Vouaux], champignon lichénicole non lichenisé rarement mentionné, parasymbiote de diverses espèces de *Squamarina*, est décrit et commenté. Par sa morphologie, il est proche de *C. ulothii* Körber, un parasymbiote de *Lecanora* du groupe de *L. muralis*, mais il en diffère par ses ascomes, ses asques, et surtout ses spores plus grands.

INTRODUCCIÓN

En el transcurso del estudio de la flora y la taxonomía de los líquenes y de los hongos liquenícolas no liquenizados de la región mediterránea de Andalucía (S de España), Aragón y Cataluña (NE de España) y de Provenza (SE de Francia), los autores han podido recolectar abundante material de un hongo del género *Cercidospora* que crece sobre diferentes especies del género *Squamarina*. Por sus características

* N. I : ver la bibliografía del presente trabajo : Navarro-Rosinés P., Roux C. & Llimona X. (1994).

morfológicas se aproxima a *Cercidospora ulothii* Körber, un hongo parasimbionte de diferentes especies del grupo de *Lecanora muralis* (Hafellner 1987), pero se diferencia de éste por el mayor tamaño de sus estructuras.

Después de consultados los principales trabajos referentes a los hongos liquenícolas, se ha constatado que nuestro hongo corresponde a un taxon ya descrito, "*Didymella*" *crozalsiiana* (Oliv.) Vouaux (Clauzade *et al.* 1989, Clauzade & Roux 1976, Keissler 1930, Vouaux 1912-1914, Olivier 1905-1907). Esta especie ha sido mal comprendida en los trabajos anteriormente mencionados, por lo que, a la vista del nuevo material estudiado, se hace además necesario reconsiderar su posición genérica.

MATERIAL Y MÉTODO

Para el estudio de los diferentes ejemplares se han realizado secciones a mano alzada, que se han montado en agua, lugol (I), lactofenol-azul algodón, o en solución acuosa de hidróxido potásico (al 10%), para su observación al microscopio óptico (máximo aumento de 1000 x). Se ha observado tanto material vivo, recolectado por los autores, como material procedente de diferentes herbarios (BCC, GDA, GZU, MARSSJ). Las medidas mencionadas se basan en material de herbario, o en material vivo tratado con lactofenol-azul algodón. En las dimensiones de las esporas se indica la media en cursiva, entre paréntesis los valores extremos absolutos, y, en medio, los valores extremos después de descartar el 10 % de los valores más altos y de los más bajos.

Para la nomenclatura de los líquenes mencionados en el texto se ha seguido la propuesta por Clauzade & Roux (1985, 1987 y 1989).

CERCIDOSPORA CROZALSIANA (OLIV.) NAV.-ROS., ROUX ET CASARES COMB. NOVA

Bas.: *Sphaeria crozalsiana* Oliv., *Bull. Acad. Int. Géogr. Bot.* 17: 168 (1906).
= *Didymella crozalsiana* (Oliv.) Vouaux, *Bull. Soc. Mycol. France* 24: 98 (1913).
Tipo.- Francia, Hérault, Béziers, leg. *A. De Crozals* (PC?, tipo no visto).
Huésped típico.- *Squamarina lentigera* (Web.) Poelt.

Ascomas peritecioides, de (160)200-280 µm de diámetro, hundidos en los talos del huésped, provistos de un excípulo formado por pequeñas células, con estructura no claramente prosoplectenquimática, próxima a la que se denomina textura intricata (Hawksworth *et al.* 1983), de color azul verdoso en la parte superior e incoloro en la base, pero que, en los ascomas más desarrollados, puede llegar a presentar una coloración azul verdosa uniforme en toda su extensión, y, en algunos de los ascomos más viejos, puede llegar a tener una tonalidad rojiza, con un grosor de 12-15(20) µm hacia la base, no o sólo ligeramente más engrosado alrededor del ostíolo.

Hamatecio formado por abundantes parafisoides de 1.5-2 µm de grosor, filiformes, articulados, simples o, raramente, con algunas anastomosis.

Ascos de 85-120 x 10-14 µm, cilíndricos, bitunicados, con el endoasco ligeramente engrosado en el ápice y provisto de una pequeña cámara apical, en su mayoría tetrasporados, pero, no raramente, algunos sólo bisporados.

Esporas de (22)24-*28,4*-32(37) x (5)5,5-*6,1*-7(8) µm (106 esporas medidas), uniseptadas, con algunas simples mezcladas, incoloras, de forma entre estrechamente elipsoidal-fusiforme a casi cilíndrica, ligeramente heteropolares, no o poco constrictas al nivel del septo, la mayoría con un halo gelatinoso de 1-2 µm de grosor claramente visible, gutuladas.

Picnidiósporas bacilares de 3-5(8) x 0,5-1 µm.

DISCUSIÓN

Cercidospora crozalsiana se aproxima, por presentar ascos tetrasporados y por la forma de las esporas, a *C. ulothii* Körber, pero se diferencia de ésta por el mayor tamaño de sus estructuras. Los ascos pueden superar los 100 µm de largo, y, en algún caso, son sólo bisporados. Las esporas superan en su mayoria los 25 µm de longitud, dimensiones a las que raramente llega *C. ulothii.*

La comprensión de este taxon ha resultado confusa en los diferentes trabajos que lo han tratado. Ya en la descripción original de Olivier (1906) se mencionan ciertos caracteres diferentes de la realidad; "spores 8 par thèque, [...], 3 septées", por lo contrario los restantes caracteres mencionados coinciden con nuestras observaciones, en especial, las dimensiones de las esporas, que coinciden perfectamente con las predominantes en la especie. Posteriormente, Vouaux (1913) reestudia el material tipo y no observa ningún hongo que presente esporas triseptadas. En su lugar, según este autor, sobre el material tipo se encuentran dos hongos con esporas uniseptadas, uno de los cuales presenta las características de "*Didymella*" *epipolytropa*, mientras que el segundo, con esporas uniseptadas e incoloras, provisto de hamatecio, y con el excípulo de color rojizo, corresponderia (Vouaux, op. cit.) a "*Didymella*" *crozalsiana.* La descripción aportada por este autor ha sido después recogida por diferentes autores para definir este taxon (Keissler 1930, Clauzade & Roux 1976, Clauzade *et al.* 1989).

En realidad, de nuestras observaciones se desprende que los dos táxones mencionados por Vouaux (op. cit.) pueden perfectamente corresponder al mismo hongo. En efecto, en parte del material de *Cercidospora crozalsiana* estudiado, se presentan algunos ejemplares con ascomas ya en mal estado, con excípulo de tonalidad rojiza.

La forma posteriormente descrita para esta especie: *Sphaeria crozalsiana* f. *saxicolae* Oliv., que crece sobre "*Squamaria saxicola*" (Olivier 1907, Vouaux 1913), debe ser considerada como un posible sinónimo de *Cercidospora ulothii.*

Conviene recordar aquí que, sobre *Squamarina*, existe otro hongo liquenícola, *Lichenochora clauzadei* Nav.-Ros., Roux y Llimona (Navarro-Rosinés *et al.* 1994), que presenta ascos octosporados y esporas triseptadas, características que, como hemos explicado ya, aparecen en la descripción original de *Cercidospora crozalsiana.* Pero, ambos táxones se diferencian claramente por la diferente estructura de los ascomas y, principalmente, por la forma y dimensiones de las esporas. En *Lichenochora clauzadei*

las esporas son triseptadas, fusiformes, con los extremos acuminados, y de dimensiones marcadamente superiores (30-45 x 6-9 µm) a las de *Cercidospora crozalsiana*.

DISTRIBUCIÓN Y HÁBITAT

C. crozalsiana parece comportarse como una especie de distribución tipicamente mediterránea, que se conoce de la localidad original (Olivier 1906, Vouaux 1913), y de las localidades de la Península Ibérica y del sur de Francia mencionadas en este trabajo. Esta especie parece que se comporta como un parasimbionte específico de diferentes especies del género *Squamarina*. Los ejemplares de la Península Ibérica se desarrollan sobre los talos de *Squamarina cartilaginea* y de *S. lentigera*, que crecen en su mayoría sobre suelos yesosos; en cambio los ejemplares de Provenza se desarrollan sobre los talos de *S. lentigera*, sobre suelos, y de *S. stella-petraea*, que crece sobre bloques alterados de areniscas carbonatadas poco elevados sobre el nivel del suelo.

Material estudiado

ESPAÑA - Andalucía - Prov. Almería, Illar, Barranco de la Canales, U.T.M. 30SWG3295, 390 m, s. data, *leg. A. Gómez-Bolea* (BCC-lich.). Sobre *S. cartilaginea*. - Prov. Almería, Sorbas, Peñón de Díaz, U.T.M. 30SWG8004, 400 m, 19.III.1988, leg. *M. Casares y L. Gutiérrez* (GDA-lich.). Sobre *S. cartilaginea*. - Prov. Almería, Sorbas, proximidades de Marchalico Viñicas, U.T.M. 30SWG8507, 400 m, 18.III.1988, *leg. M. Casares y L. Gutiérrez* (GDA-lich.). Sobre *S. cartilaginea*. - Prov. Almería, Tabernas, Venta de los Yesos, U.T.M. 30SWG6205, 500 m, 20.II.1988, *leg. M. Casares, A. Rupérez y L. Gutiérrez* (GDA-lich.). Sobre *S. lentigera*. - Prov. Almería, Viator, Cuevas de los Medinas, U.T.M. 30SWF6184, 200 m, 15.VI.1989, *leg. M. Casares y L. Gutiérrez* (GDA-lich.). Sobre *S. lentigera*. - Prov. Granada, Benamaurel, Cañada del Caballo, U.T.M. 30SWG2566, 720 m, 26.II.1988, *leg. M. Casares, A. Rupérez y L. Gutiérrez* (GDA-lich.). Sobre *S. cartilaginea*. - Prov. Granada, carretera de Baza-Benamaurel, Monzón, U.T.M. 30SWG2456, 690 m, 3.II.1990, *leg. M. Casares, A. Rupérez y L. Gutierrez* (GDA-lich.). Sobre *S. cartilaginea*. - Prov. Sevilla, Carmona, Tumba de Servilia, 100-200 m, 8.III.1994, *leg. X. Ariño, A. Gómez-Bolea y A. Canals* (BCC-lich.). Sobre *S. lentigera*. - **Aragón** - Prov. Zaragoza, Alfajarín, cerca del Castillo, 350 m, 4.1.1972, *leg. X. Llimona* (BCC-lich.). Sobre *S. lentigera*. - Prov. Zaragoza, los Monegros, Gipshügel ca. 5 km von Bujaraloz, ca. 70 km E von Zaragoza, ca. 250 m alt., offenes *Juniperetum thuriferae*, 25.V.1983, *leg. J. Hafellner* (GZU, Herb. J. Hafellner 17419). Sobre *S. lentigera*. - **Cataluña** - Prov. Lleida, la Segarra, Torà, cerca del pueblo, U.T.M. 31TCG62, 450-500 m, 5.I.1972, *leg. X. Llimona* (BCC-Lich.). Sobre *S. lentigera*. - Prov. Lleida, la Segarra, Torà, lomas próximas a la carretera a Castellfollit, U.T.M. 31TCG6828, 470 m, 15.IV.1988, *leg. P. Navarro-Rosinés y X. Llimona* (BCC-Lich.). Sobre *S. lentigera*.- *Ibid.*, 8.VIII.1988, *leg. P. Navarro-Rosinés* (BCC-lich.; GZU, Herb. J. Hafellner). Sobre *S. lentigera*.

FRANCIA - Provenza - Bouches-du-Rhône, Auriol, à terre, 8.XII.1949, *leg. L. Berner* (MARSSJ, Herb. B. de Lesdain). Sobre *S. lentigera*. - Vaucluse, Gordes, col de Gordes, 350 m, 14.V.1993, *leg. P. Navarro-Rosinés y C. Roux* (BCC-Lich, MARSSJ). Sobre *S. stella-petraea*.- Ibid., 10.VI.1993, *leg. G. Clauzade, M. Glenn, P. Navarro-Rosinés y C. Roux* (BCC-Lich, MARSSJ). Sobre *S. stella-petraea*. - Vaucluse, St.-Saturnin-d'Apt, La Tuilière, 250 m, sol marneux non ombragé à peu près horizontal, sur marnes gargasiennes, 26.IX.1964, *leg. G. Clauzade* (MARSSJ, Herb. G. Clauzade). Sobre *S. lentigera*.

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Source : MNHN, Paris

SOME BRYOPHYTES FROM SOUTHERN ITALY, INCLUDING NEW RECORDS OF *TORTULA BOLANDERI* AND *ASCHISMA CARNIOLICUM*

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ABSTRACT - 29 noteworthy bryophyte records are reported from Campania and Sicily. *Tortula bolanderi* is new to Italy in a second European station, and *Aschisma carniolicum* has been found for the first time in Italy since 1913.

RÉSUMÉ - 29 bryophytes sont signalées de la Campanie et de la Sicile. *Tortula bolanderi* est nouvelle pour l'Italie, dans une deuxième localité européenne, et *Aschisma carniolicum* a été trouvé pour le premier fois en Italie depuis 1913.

INTRODUCTION

Recent years have seen considerable progress in the study of Italian bryophytes. Cortini Pedrotti has published a bryological bibliography of the country, a comprehensive check-list of the mosses, and a red list of Italian bryophytes (Cortini Pedrotti 1986, 1992, Cortini Pedrotti & Aleffi 1992a). A check-list of the hepatics is due to be published shortly (Aleffi & Schumacher, *in prep.*). At a more regional level, there have been separate check-lists for Sicily (Dia *et al.* 1985, Dia *et al.* 1987), and a detailed study of the Apuan Alps (Cortini Pedrotti *et al.* 1991), in addition to more local floristic studies. Nevertheless many parts of the country remain poorly known, and many of the records which do exist have not been confirmed for many years. The red list of Italian bryophytes documents the large number of species which have not been recorded since 1950. It is not surprising, therefore, that even brief and limited investigations can produce new records of interest, and re-discoveries of older ones (cf. Townsend 1994).

This paper reports some records made during visits to Sicily in April 1993, and to Campania in March-April 1994. These records include a first report for *Tortula bolanderi* in Italy, and a first modern record for *Aschisma carniolicum*. Most of the records listed below are new to their respective regions, or have not been recorded since before 1950 (Cortini Pedrotti 1992, with additional records for Campania in Cortini Pedrotti *et al.* 1993). New records are prefixed by a double asterisk (**), and recent records by a single asterisk (*). The specimens cited are located in the author's personal herbarium.

Nomenclature follows Corley *et al.* (1981) and Corley & Crundwell (1991) for mosses, and Grolle (1983) for hepatics.

SICILY

***Lophozia ventricosa* var. *ventricosa* (Dicks.) Dum. - At base of shaded lava boulder on steep slope overlooking the southern edge of the Valle del Bove, M. Etna, *TLB 22/129*.

**Cynodontium bruntonii* (Sm.) B., S. & G. - In crevices of lava rocks in Pine forest, Pineta di Linguaglossa, M. Etna, *TLB 22/136*.

***Dicranoweisia cirrata* (Hedw.) Lindb. - At base of *Pinus nigra* bole, Pineta di Linguaglossa, M. Etna, *TLB 22/155*.

**Encalypta ciliata* Hedw. - In gully and on bank of lava in Pine forest, Pineta di Linguaglossa, M. Etna, *TLB 22/139 p.p., 22/152*.

***Tortula bolanderi* (Lesq. & James) M. A. Howe - On friable crust of soil on vertical roadside bank, on the outskirts of Vizzini, by the road to Caltagirone, *TLB 22/091*.

Plants occurring as scattered shoots to 2.5 mm tall, dark green, leaves commonly tinged red-brown at the apices and at the back of the nerve. Leaves erect and appressed or weakly curled when dry, erect spreading when moist, to 2 mm long, lingulate, rounded or sometimes broadly pointed at the apex, somewhat cucullate; margins entire, recurved at mid-leaf and sometimes almost to the apex; nerve percurrent or ceasing slightly below the apex, stout, 60-70 µm wide at mid-leaf, prominent dorsally, the ventral surface with quadrate multi-papillose cells, the dorsal with elongate cells bearing scattered low conical papillae; nerve section with large well-defined guide cells and a hydroid strand, a dorsal stereid band and weakly differentiated dorsal epidermis, and a ventral superficial layer of papillose cells. Upper leaf cells quadrate, 4-9 µm wide, densely and obscurely multi-papillose, the marginal cells in 5-8 rows incrassate, less densely papillose, forming a pale band; basal cells lax, rectangular, gradually differentiated, the walls becoming pale brown with age, the marginal cells narrower with 1-2 rows of linear cells sometimes differentiated. Rhizoidal tubers present, sparse, on slender rhizoids, irregular in shape, pale brown with dark brown walls, to 60 µm in diameter. Gametangia not seen (plants elsewhere dioecious).

T. bolanderi has been reported only once previously in Europe, from southern France (Crundwell & Whitehouse 1976), but it is now known to be widespread in the Canary Islands (Dirkse *et al.* 1993). The Sicilian plants agree well with the French, and the identification has been confirmed by Mr. Crundwell. The status of the species in Europe remains uncertain. Both collections have been from roadside banks. This fact, and the apparent rarity of the species in Europe, may suggest an introduced origin. However, it is not a conspicuous plant and it may yet be found to occur more widely in southern Europe. It is most likely to be confused with *T. inermis* (Brid.) Mont., which may have similarly differentiated marginal leaf cells. However, *T. inermis* has larger

leaf cells and more strongly recurved leaf margins, and it is autoecious and commonly fertile.

Tortella inflexa (Bruch) Broth. - On stones in the gardens at the Latomia, Siracusa, *TLB 22/060* p.p., and on bank by the Roman Amphitheatre, Siracusa, *TLB 22/065.*

Cinclidotus mucronatus (Brid.) Mach. - On boulder by stream, in gully at ca. 550 m alt., by the N185 road NW of Francavilla, *TLB 22/188.*

Aulacomnium androgynum (Hedw.) Schwaegr. - On loamy soil on bank by path in Pine forest, Pineta di Linguaglossa, M. Etna, *TLB 22/153.*

CAMPANIA

****Lophozia collaris*** (Nees) Dum. - On damp shaded limestone, ca. 1350 m alt., M. S. Angelo a tre Pizzi, Lattari Mountains, *TLB 23/068.*

Pedinophyllum interruptum (Nees) Kaal. - On damp shaded limestone in deep wooded valley, Valle dei Molini, Amalfi, *TLB 23/049.* - On damp shaded limestone in ravine, ca. 500 m alt., ca. 3 km SW of Acerno, M. Picentini, *TLB 23/053.*

****Cololejeunea rossettiana*** (Mass.) Schiffn. - On limestone blocks of old retaining wall in deep wooded valley, Valle dei Molini, Amalfi, *TLB 23/045.* In addition to this and the next species, *C. calcarea* (Libert) Schiffn. also occurs in the Valle dei Molini. There are few other places in Europe where these three species grow in close proximity.

****Cololejeunea minutissima*** (Sm.) Schiffn. - On tree boles in deep wooded valley, Valle dei Molini, Amalfi, *TLB 23/043.*

Distichium capillaceum (Hedw.) B., S. & G. - On damp calcareous matter on steep slope in ravine, ca. 500 m alt., ca. 3 km SW of Acerno, M. Picentini, *TLB 23/055 p.p.*

****Ditrichum crispatissimum*** (C. Müll.) Par. - On steep lightly shaded rocky bank, ca. 1400 m alt., M. S. Angelo a tre Pizzi, Lattari Mountains, *TLB 23/071.*

Trematodon longicollis Michx. - On warm bare ground in volcanic crater, La Solfatara, Pozzuoli, *TLB 23/077.* The first report of *T. longicollis* from La Solfatara was made by Giordano (1871), and the species has been recorded on various occasions from the nearby island of Ischia, where it was first found and described by Bolle (1865, as *T. solmsii*). The present record is welcome confirmation of one of the few European stations for this species of tropical and sub-tropical distribution.

****Barbula crocea*** (Brid.) Web. & Mohr - On damp calcareous matter on steep slope in ravine, ca. 500 m alt., ca. 3 km SW of Acerno, M. Picentini, *TLB 23/054.*

****Aschisma carniolicum*** (Web. & Mohr) Lindb. - On dry calcareous soil on south facing slope, among *Weissia controversa* Hedw. and *Pottia starckeana* (Hedw.) C. Müll, Punta Campanella, west of Sorrento, *TLB 23/080 p.p.*

Plants minute, ca. 1.5 mm tall, occurring as isolated individuals. Upper leaves 1-1.2 mm long, ovate to narrowly ovate-oblong with acute apex, incurved when dry,

erect and somewhat concave when moist; margins plane, entire; nerve stout, percurrent, forming an acute point to the leaf, often somewhat wider at mid leaf than at the base, prominent dorsally, in section with weakly differentiated guide cells, a strong dorsal stereid band, 1-2 rows of ventral stereids and a superficial ventral layer of papillose cells. Upper lamina cells quadrate, ca 5 µm wide, dense, obscure and strongly multi-papillose, slightly more incrassate and less papillose at leaf margins; basal cells rectangular, 5-10 µm wide, often forming a V-shaped zone, thin-walled at extreme base of leaf, becoming thick-walled above and merging gradually with the upper cells. Cells overlying ventral surface of nerve rectangular or sometimes quadrate, papillose; dorsal nerve cells elongate, incrassate. Capsule immersed on a very short seta, readily becoming detached at maturity, spherical with a small apiculus; lid not differentiated; calyptra conic; capsule walls delicate, the exothecial cells across the centre of the capsule large, thin-walled, rectangular (about 4-5:1), arranged in palisade-like tiers; spores 16-20 µm, very finely papillose.

This collection consists of a few shoots only, collected hurriedly at the onset of a heavy rain shower. *Aschisma* is an inconspicuous moss, and there is no reason to suppose that it is not present in good quantity at this site. Previous reports from Italy are from Sardinia (Colla 1836), Tuscany (Levier 1905), and Sicily, in the vicinity of Messina (Zodda 1907, 1913, Villari *et al.* 1980). Düll (1992) states, without explanation, that records from mainland Italy are wrong. In any case, the present record is apparently the first for Italy since Zodda's report in 1913.

A. carniolicum resembles a small *Phascum*, but differs in the presence of a ventral stereid band in the nerve, the very small size of the upper leaf cells, the tendency of the basal cells to form a V-shaped group, and the large, delicate exothecial cells of the capsule, which are arranged in high tiers.

Racomitrium canescens (Hedw.) Brid. - On turfy slope on exposed summit, ca. 1440 m alt., M. S. Angelo a tre Pizzi, Lattari Mountains, *TLB 23/075*.

Mnium marginatum (With.) P. Beauv. - In stony crevices on bank in Beech woodland, ca. 1350 m alt., M. S. Angelo a tre Pizzi, Lattari Mountains, *TLB 23/069*.

Plagiopus oederiana (Sw.) Crum & Anderson - On limestone rock ledge, ca. 1350 m alt., M. S. Angelo a tre Pizzi, Lattari Mountains, *TLB 23/067*.

****Neckera pumila*** Hedw. - On bole of mature Beech tree, ca. 1250 m alt., M. S. Angelo a tre Pizzi, Lattari Mountains, *TLB 23/063*.

****Metaneckera menziesii*** (Hook.) Steere - On steep lightly shaded rocky bank, ca. 1350 m alt., M. S. Angelo a tre Pizzi, Lattari Mountains, *TLB 23/073*.

Antitrichia curtipendula (Hedw.) Brid. - On steep lightly shaded rocky bank, ca. 1400 m alt., M. S. Angelo a tre Pizzi, Lattari Mountains, *TLB 23/072*.

Myurella julacea (Schwaegr.) B., S. & G. - On damp calcareous matter on steep slope in ravine, ca. 500 m alt., ca. 3 km SW of Acerno, M. Picentini, *TLB 23/055 p.p.* Until recently this species was know only from the northern part of Italy. However, Cortini Pedrotti & Aleffi (1992b) have reported it recently from the Abruzzo National Park, and Cortini Pedrotti *et al.* (1993) have found it independently in Campania.

****Anomodon attenuatus*** (Hedw.) Hüb. - On shaded limestone boulders in ravine, ca. 500 m alt., ca. 3 km SW of Acerno, M. Picentini, *TLB 23/050, 23/056.*

****Thuidium recognitum*** (Hedw.) Lindb. - On turfy ground in open *Castanea* wood, ca. 740 m alt., Acerno, M. Picentini, *TLB 23/060.*

Amblystegium serpens (Hedw.) B., S. & G. - At base of tree bole by stream, ca. 500 m alt., ca. 3 km SW of Acerno, M. Picentini, *TLB 23/058.*

Plagiothecium nemorale (Mitt.) Jaeg. - On base of Beech tree, ca. 1300 m alt., M. S. Angelo a tre Pizzi, Lattari Mountains, *TLB 23/064.*

Rhytidiadelphus triquetrus (Hedw.) Warnst. - On limestone rock ledge, ca. 1400 m alt., M. S. Angelo a tre Pizzi, Lattari Mountains, *TLB 23/074.*

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A NEW *FRULLANIA* SPECIES (*TRACHYCOLEA*) FROM PORTUGAL AND MACARONESIA, *FRULLANIA AZORICA SP. NOV.*

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ABSTRACT - Observations on the morphology combined with computer-assisted analyses of phenetics (principal component analysis) as well as chemical detection and isolation of flavonoid and terpenoid compounds, have confirmed the existence of a new species, *Frullania azorica*. *Frullania azorica* is maintained within the subgenus *Trachycolea*, where it is possibly closely related to *F. eboracensis* though not easily separated from sterile forms of *F. dilatata*. The species occurs in Portugal and the Atlantic Islands (Azores, Madeira and Canaries).

In 1894 Tavares Carreiro collected material of a *Frullania* on S. Miguel Island, Azores, which was named by Corbière as "*F. azorica. sp. nov.*" in herb. Machado. However, the name was not validly published, nor was a holotype designated. Following a revision of *Frullania* specimens from the Azores, Madeira, the Canary Islands and one locality in Portugal (Serra da Estrela where the species was collected in 1910-1915 by Luisier and determined as *F. dilatata* (L.) Dum.), Sérgio (1985 a, b) concluded that some populations were similar to the hepatic studied by Corbière, and were conspecific with *F. muscicola* Steph. from Asia. Sérgio (1985 b) also concluded that *F. muscicola* is related to *F. cesatiana* from the southern belt of the Alps in Europe. *F. muscicola* is a polymorphic taxon with a wide distribution in Asia (China, Japan, Korea and India) and includes several forms and subspecies (Kamimura 1961, Hattori 1974).

In 1989 Bisang *et al.* considered *F. muscicola* from Macaronesia and Asia as a variety of *F. cesatiana* De Not.

In clarifying the taxonomic positon of the new species, biochemical technics proved to be of considerable importance, providing the isolation and identification of the main flavonoid and terpenoid compounds of this taxon and the determination of the general pattern in related taxa (Kraut 1993, Kraut *et al.* 1993, 1994, 1995), as well as revealing preliminary isoenzymatic affinities between related taxa.

Statistical multivariate analysis of morphological characters, together with the use of classical methods, was decisive in determining the taxonomic position of the new species (Sim-Sim 1995).

We consider that the present observations support the recognition of *F. azorica* as a new species of the *Trachycolea* subgenus.

FRULLANIA AZORICA SIM-SIM, SERGIO, MUES & KRAUT *SP. NOV.*

[Figs. 1 - 2]

Holotypus: Azores, Terceira, Porto Martins, Praia da Vitória, *Gabriel & Borges*, s.n., 16.02.1991, LISU 156109. - **Paratypes**: Azores, Terceira, Praia da Vitória, *Dias*, 15.12.1990, LISU 156110; Azores, Terceira, Porto Martins, *Dias*, 12.1990, LISU 156108; Azores, Pico das Canas, *Carreiro*, 28.07.1894, hb. Carlos Machado, sub *F. azorica* Corb. *(nom. herb.)*, AZ, dupl. CHER; Madeira, Boaventura, Sítio do Silveira, 11.10.90, *Sim-Sim et al.*, LISU 156118. - **Synonyms**: *Frullania muscicola sensu* Sérgio, *Portug. Acta Biol. (B)* 14: 161-167, 1985, *non* Steph.; *Frullania cesatiana* De Not. var. *muscicola* (Steph.) Bisang *et al. Giorn. Bot. Ital.* 122 (5-6): 255-266, 1988, *p.p.*

Planta mediocris, irregulariter ramosa; lobi foliorum caulinorum imbricati, concavi, ovati-oblongi, apice rotundati, basi dorsali arcuati (haud auriculati vel appendiculati), cellulis medianis, trigonis magnis, triangulatis vel nodulosis, lobulis cucullatis raro explanatis; styli mediocres, ad 4-7 cellulas longi, 6-10 cellulas lati ad basim, amphigastria transverse inserta, distantia, fere duplo latiora quam longa, saepe dente laterali armata, 1/2 bifida, lobis subtriangularibus, acutis.

Plantae dioicae. Androecia in ramis brevibus lateralibus, bracteis compactis, 5-12 jugatis. Gynoecia terminalia in caule vel ramo; lobus bracteae intimae oblongus, apice obtusus, lobulo breviter connato, oblongo, margine dentato, profunde bifido, lobis lanceolatis, ad apicem attenuatis; perianthium 1/2 exsertum, late pyriforme (apice late subtruncatum), 4-carinatum (2 carinis ventralibus, 2 lateralibus) carina irregulariter undulato-crenulata. Sporae orbiculares ad oblongae, 34-67 µm diametro longae.

Plants medium sized to robust, dull deep green to brown, in small to large mats, closely adnate to the substrate, leafy shoots 1.0-2.5 cm long and (700-) 990 (-1500) µm wide, irregularly 1(2)-pinnate, stems (90-) 115 (-150) µm in diameter. Leaves closely imbricate, lobes strongly overlapping the stem. Dorsal lobes broadly oval to oblong, longer than wide, concave, rounded at apex, rounded base extending slightly beyond the stem only on the farther side, (460-) 700 (-1050) x (380-) 550 (-700) µm. Lobules galeate, erect, parallel and lying contiguous to the stem, normally inflated, as long as wide, with the postical portion slightly longer, mouth open-truncate not rostrate, rarely explanate, (120-) 210 (-350) x (130-) 200 (-310) µm. Stylus subulate, large (80-) 113 (-160) µm, 3-6 cells wide below and 4-7 cells uniseriate, ending in a mucilaginous cell. Cells of lobe margin 15-20 µm, isodiametric, median cells oval to polygonal, (15-) 24 (-32) x (11-) 18 (-25) µm, with strongly confluent trigones and intermediate

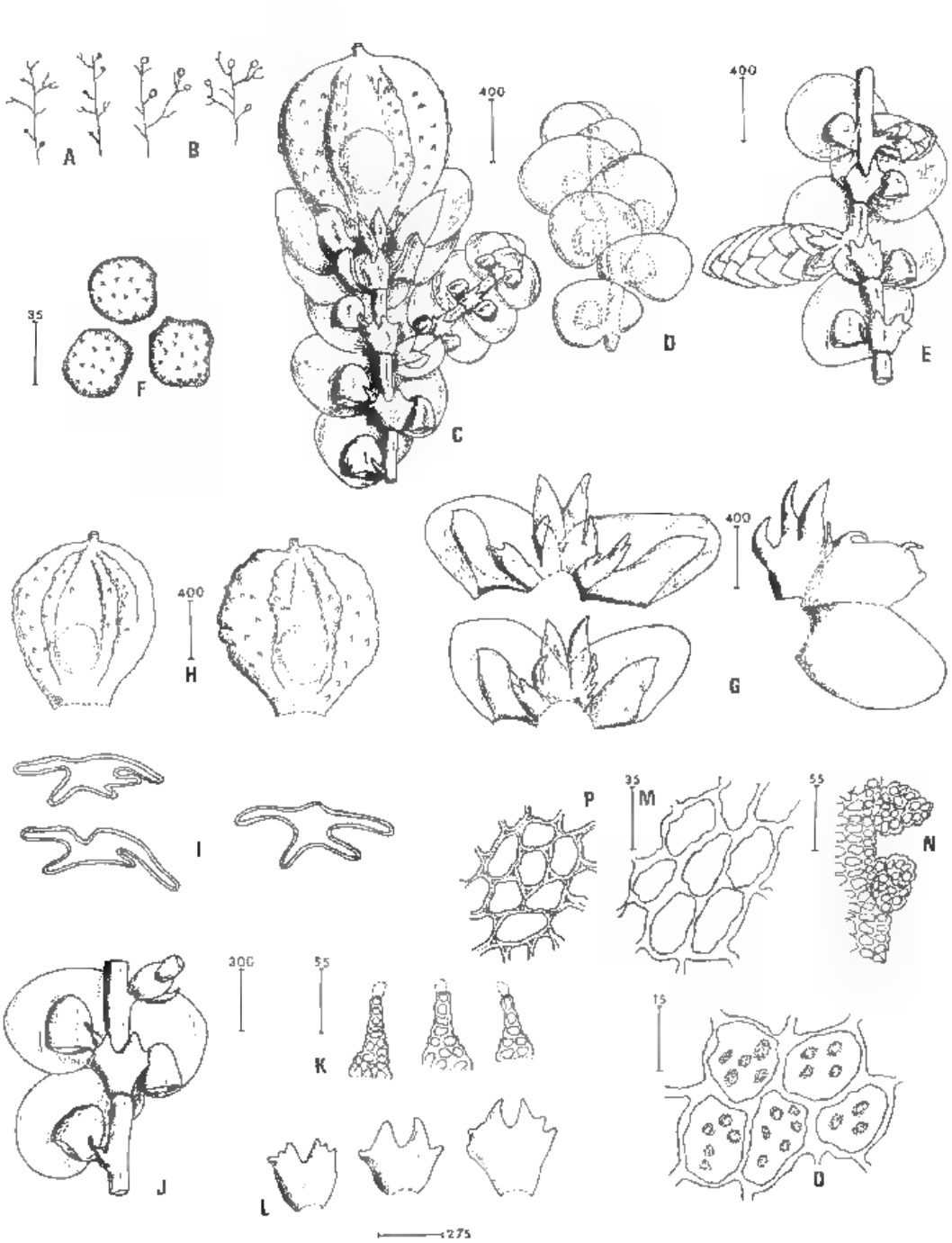

Fig. 1. - *Frullania azorica*. **A, B** - Male and female gametophyte with male branches and perianths; **C, D, E** - Gametophyte segments; **F** - Spores; **G** - Innermost pair of bracts and bracteole; **H** - Perianths; **I** - Perianths sections; **J** - Gametophyte segment; **K** - Stylus; **L** - Underleaves; **M** - Basal cells from dorsal lobe; **N** - Gemmae from dorsal lobe marginal cells; **O** - Median cells from dorsal lobe; **P** - Median cells from dorsal lobe. (Scale in μm). - All from the Holotype, excluding J - L and N, *Sim-Sim & Sérgio*, 10.12.90, LISU 156114.

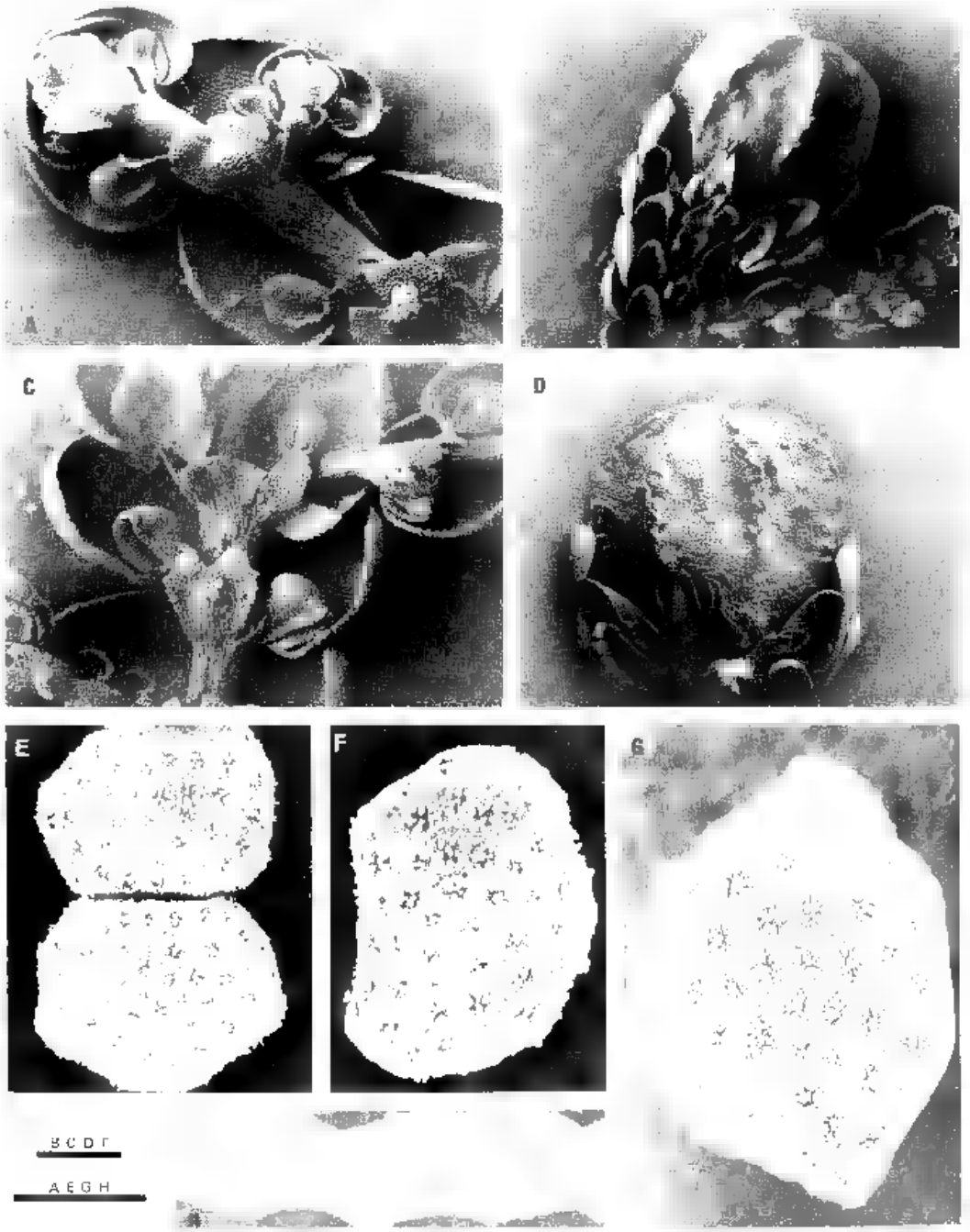

Fig. 2. - **A - F:** *Frullania azorica*. **A** - Gametophyte segment; ■ - Gynoecium; **C** - Gametophyte segment; **D** - Gynoecium; **E** - Pair of spores; **F** - Spore; **G:** *Frullania eboracensis*. **G** - Spore. (Scale: **A,** ■ - 400 µm; ■ - 500 µm; **C** - 200 µm; **E** - 20 µm; **F, G** - 10 µm. All from the Holotype, excluding G, *Greene & Ducan*, 1991 (LISU).

thickenings; cells in middle of lobule isodiametric to suboval, (11-) 16 (-23) x (11-) 16 (-23) µm. Oil bodies suboval to oval, granular-botryoidal, 3-6 per cell. Ocelli absent.

Underleaves remote, subquadrate, 2 x stem width, ca. 0.3-0.5 bifid, with acute lobes, margins 1-2 acutely dentate with 3-4 cells on each side, cuneately narrowed to base, (150-) 230 (-380) x (150-) 238 (-360) µm; middle cells slightly longer, (14-) 20 (-27) x (10-) 13 (-18) µm. Rhizoids in small fascicles from middle cells of underleaves. Hemiphyll as long as broad, (190-) 250 (-400) x (150-) 220 (-360) µm, dorsal lamina lanceolate, ventral lamina oval, unequally bilobed, with one of the lobes corresponding to a stylus of 6-8 cells, ending in a mucilaginous cell. Asexual reproduction frequent by multicellular gemmae, produced on leaf margins, underleaves and stem.

Dioecious. Male plants of the same size, pinnate, androecia on short lateral branches, subsessile, subcylindric, dorsiventrally compressed, compact, with 5-12 pairs of bilobed bracts; basal pair with lanceolate lobule and a bracteole, (500-) 998 (-2200) x (400-) 680 (-1100) µm. Gynoecia terminal on leading shoots or short lateral branches. Bracts in 3-4 pairs asymmetrically bilobed. Innermost bract (780-) 920 (-1200) x (580-) 740 (-860) µm, with 2 lobes, dorsal lobe oblong to suborbicular, rounded at apex, entire; lobule oblong-lanceolate, acute, margin revolute with a strongly lanceolate segment on ventral margin and a long stylus ending in a mucilaginous cell, near base; bracteole (600-) 740 (-900) x (300-) 370 (-450) µm, shortly connate with bract lobules at both sides, oblong to suboblong, 0.5-0.75 bilobed, the lobes triangular and sharp, with 2 strong styli each ending in a mucilaginous cell, near base. Perianth half exserted, (1000-) 1320 (-1700) x (800-) 1196 (-1700) µm, pyriform, approximately as long as wide, dorsiventrally compressed, subtrapezoidal, weekly tuberculate with crenulate verrucose keels; 2 lateral keels, and 2 broad and strong ventral keels, often with 1-2 small additional keels; wall of median cells irregular with trigones, (17-) 30 (-45) µm; truncate at apex, quickly narrowed into a short subcylindric beak, (70-) 97 (-150) x (57-) 78 (-100) µm, with smooth opening. Capsule globose, inner cell layer with long cells, (25-) 42 (-60) µm, spores globose, (34-) 50 (-67) µm, with 7-8 rosettes of 4.5-5.0 µm in the equatorial diameter, consisting of 5-6 subtriangular outgrowths, 1.5-3.8 µm, not reaching the central part where one outgrowth is differentiated; elaters 1-spiral, trumpet shaped, (200-) 300 (-400) x (8-) 14 (-20) µm.

For the nomenclature of this species, we have adopted the specific epithet applied by Corbière as herbarium name for the S. Miguel collection. The holotype and three paratypes were selected from specimens material from the Azores and Madeira, with well developed populations with sporophytes and mature spores. The sample studied by Corbière is designated as a paratype.

Morphological and chemical data

The new taxon belongs to a group of closely related species, the *Frullania dilatata* - *F. muscicola* - *F. eboracensis* complex, which shows its wide geographic distribution and requires revision using modern biochemical techniques as a complement to morphological criteria (Schuster 1992).

The present investigation was initiated as an exploratory study of the variation in this complex. Forty seven specimens (10 of *F. azorica* from Madeira, 23 of *F. dilatata* from Portugal and Madeira, 7 of *F. eboracensis* from North America and 7 of *F. muscicola* from Japan) constitute the operational taxonomic units (OTUs) whose

	F. dilatata	*F. azorica*	*F. eboracensis*	*F. muscicola*	*F. cesatiana*
Cell wall	not sinuous with trigones	not sinuous with trigones	sinuous with trigones	not sinuous with trigones	not sinuous with small trigones
Stylus	large lanceolate 8-10 cells below	large subulate 3-6 cells below	small lanceolate 2-3 cells below	small filiform 2-3 cells below	small filiform 2-3 cells below
Underleaves	with acute lobes 1-2 blunt teeth on lateral margin	with acute lobes 1-2 blunt teeth on lateral margin	with subacute to blunt lobes, margin entire or with 1 blunt tooth	with suacute to acute lobes, 1-2-3 acute or blunt teeth on lateral margin	with blunt lobes lateral margin entire
Lobules	large, not rostrate	large, not rostrate	small, not rostrate	large, with small rostrum	small, not rostrate
Hemiphyll	ventral lamina with stylus	ventral lamina with stylus	ventral lamina without stylus	ventral lamina without stylus	ventral lamina with minute stylus
Bracts and Bracteoles	margin weakly dentate	margin strongly dentate	margin weakly dentate	margin weakly to moderately dentate	weakly ?
Perianth	allways tuberculate not dorsiventrally compressed with 1 ventral keel	weakly tuberculate on keels, compressed with 2 broad ventral keels	not or weakly tuberculate on keels, not dorsiventrally compressed with 1-2-3 ventral ridges	weakly tuberculate on keels, dorsiventrally compressed with 2 broad ventral keels	
Spores	surface with rosettes	surface with rosettes	surface without rosettes	surface with rosettes	

Table 1. Diagnostic characters of the *Frullania* species studied.

relationships were investigated. *Frullania cesatiana* was not considered as it lacked reproductive structures. The data consisted of 53 morphological characters scored for each of 47 OTUs. Both quantitative and qualitative characters from the morphology of *Frullania* were defined. The quantitative characters represent sample means for each OTU.

Measurements were taken from approximately the same position on the plant for each specimen and included the length and width of the dorsal and ventral lobes, stylus, hemiphyll, underleaves, median cells, perianths and perianth wall cells, capsules and inner wall cells, elaters and spores. The qualitative characters were binary coded and complement the quantitative characters used in the phenetic analysis. Among the characters considered were the form of the lobe apex and base, the type of lobule, the extent of revoluteness along the margins of the underleaves, the length of the sinus and the underleaf base, perianth morphology, as well as the rosette pattern along the equatorial walls of the spores.

The data were analyzed using NT-SYS (Rohlf 1992). The first three principal component axes account for 46% of the total character variation. This analysis supports the recognition of the four species of *Frullania*. *F. azorica* and *F. muscicola* are well separated from each other and from the remaining taxa (Fig. 3). *Frullania dilatata* and *F. azorica* are more similar to each other, an outlier OTU of *F. dilatata* was found, corresponding to a plant with a stylus similar to that of *F. azorica*. However the perianth features and the flavonoid analysis revealed a general pattern characteristic of *F. azorica*.

Up to the present, *F. azorica* has been considered conspecific with *F. muscicola* from Asia. The study of several samples from Asia, including the holotype from Yunnan, China, confirmed the large morphological variation of the Asiatic taxon, and the detection of distinct and stable characters for both species (Table 1). This is also supported by the different flavonoid patterns found in the two taxa as well as by differences in the main terpenoid compounds (Kraut 1993, Kraut *et al.* 1993) (Table 2).

Morphologically *F. azorica* is not a highly variable species as other *Trachycolea* species, though a certain variation in the dimensions and morphology of stylus and underleaves was observed. When sterile its distinction from atypical forms of *F. dilatata* may be difficult. However, *F. azorica* can be distinguished from *F. dilatata* by the diagnostic characters listed in Table 1, and the main flavoid compounds (Table 2).

F. cesatiana is a small and fragile species from the Italian-Swiss lakes region, and has never been collected with sporophytes. It is a taxon that seems to have developed separately, in a restricted region with a warm and rainy season . The study of several samples of *F. cesatiana* has made possible the recognition of its morphological distance from *F. azorica* (Table 1). The main flavonoid composition of the two, is also different from all the other taxa studied (Kraut 1993, Kraut *et al.* 1993, Kraut *et al.* 1995), (Table 2).

F. eboracensis Gottsche is a variable taxon with a wide distribution in eastern North America, and is as ecologically diversified as *F. dilatata* (L.) Dum. is in Europe (Schuster 1992), including subsp. *virginica* and subsp. *parvistipula* from Japan. However *F. parvistipula* Steph. is considered an independent species in Europe by

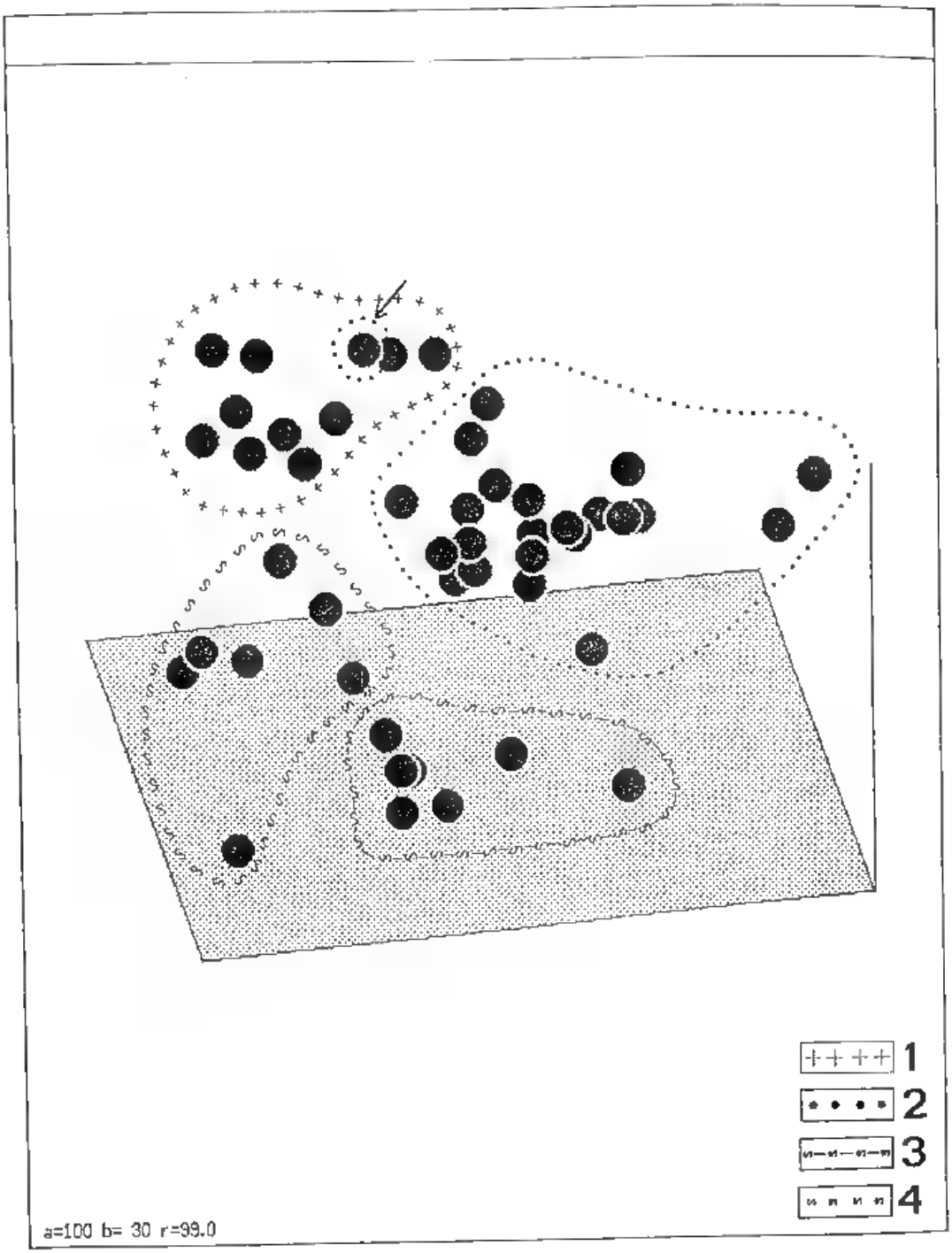

Fig. 3. - Projections of OTUs on the first three principal component analysis factors of 53 characters, explaining 46% of the total variance. **1**= *F. azorica*; **2**= *F. dilatata*; **3**= *F. muscicola*; **4**= *F. eboracensis*. - a: the rotation angle around the Z-axis in degrees; b: the TILT angle around the X-axis in degrees; r: the distance, rho, from the observer to the object. The minimum is 0,01.

COMPOUNDS	*F. dilatata**	*F. azorica*	*F. eboracensis*	*F. muscicola*	*F. cesatiana*
Free flavone aglicones	+	-	-	-	-
6-OH-luteolin-O-glycosides (including acylated derivatives)					
6-OH-luteolin-type	+	+	+	-	-
luteolin-type	+	+	+	-	-
scutellarein-type	-	+	+	-	-
flavone-di-O-glycosides (including acylated derivatives)					
6-OH-luteolin-type	-	-	-	-	+
luteolin type	+	-	-	-	-
flavone-C-glycosides	-	-	-	+	+
glycerol glycosides acylated with phenylpropanoic acid	?	+	+	-	?
sesquiterpene lactones					
eudesmanolides	+	+	+	?	+
eremophilanolides	+	+	?	?	?
bibenzyl derivatives					
bibenzyls	+	?	?	?	?
3-benzylphthalides	-	+	?	?	?

+ compound type isolated and identified.
- compound type not detected.
? presence of compound type according to TLC and/or GC, but not isolated and identified.
* data regarding terpenoids and bibenzyls of *F. dilatata* according to Asakawa (1982) and Nagashima *et al.* (1994).

Table 2. Major types of secondary compounds detected in *Frullania* species studied.

Rüegsegger (1986). *F. eboracensis* can also be distinguished from *F. azorica* by a group of characters mentioned in Table 1, but mainly by spore-wall ornamentation, which is different from that in all other species of the complex (Fig. 2).

As regards biochemistry, flavonoid and terpenoid analysis of both taxa has revealed almost the same qualitative composition for the main compounds (Kraut 1993, Kraut *et al.* 1993, Kraut *et al.* 1995). The preliminary isoenzymatic analysis of acid phosphatase and glutamate dehydrogenase, together with classical taxonomic methods and phenetic analysis (Fig. 3), proved to be important and decisive in distinguishing *F. eboracensis* and *F. azorica*.

F. azorica was also compared with *F. obscurifolia* Mitt., a variable taxon from Africa (Vanden-Berghen 1976). This species was confirmed as belonging to the same subgenus, but can be separated mainly by the presence of longer leaf lobules, broader underleaves and female bracts and bracteoles with weakly dentate margins.

According to Schuster (1966) *Frullania* is a "modern" group of liverwort species, with a relatively high "success" rate in the evolution of endemic species. Actually *F. azorica* is restricted to Macaronesia, where the number of endemic species is high (Sunding 1973).

The flavonoid resemblance between *F. azorica* and *F. eboracensis*, might indicate evolution from a common ancestor. Macaronesia originated in the Tertiary and it is assumed that the Azores have been influenced by the American continent, while Madeira has been mainly influenced by Europe. *F. dilatata* has not been reported for the Azores, where *F. azorica* is frequent. In Madeira both *F. dilatata* and *F. azorica* are frequent.

Shaw (1985) comments that the differences in geographic pattern support taxonomic separation and the ranges reflect different evolutionary origins for the taxa and imply past, if not present, genetic differentiation, especially when considered in conjunction with morphological discontinuities.

Ecology

The present ecological data refer mainly to Macaronesian plants. *Frullania azorica* usually develops near the sea, on exposed rocks covered with a thin layer of soil but can be also found as epiphyte (Sim-Sim & Sérgio 1992).

It is an early colonist element, forming more or less extense colonies on coastal basaltic rocks, or on tree trunks. In the *loc. class.* it grows associated with *Roccella* species.

In Madeira and Porto Santo, the colonies do not exceed 10 cm in diameter. It can be considered a xeromesophilous element, found sometimes in open places in *Laurisilva* forest on Madeira. On these islands it develops in association with other bryophyte species such as *F. dilatata, F. tamarisci* (L.) Dum., *F. ericoides* (Nees) Mont., *Plagiochila killarniensis* Pears., *Homalothecium sericeum* (Brid.) Broth. and *Leucodon canariensis* (Brid.) Schwaegr., growing mainly on *Ocotea foetens* (Ait.) Benth. & Hook. f. and *Laurus azorica* (Seub.) Franco.

Distribution

It is known from the Atlantic Islands, Madeira, Azores and Canárias. In the beginning of the century it was collected in Portugal, Serra da Estrela, where it couldn't be found again. It's presence in Spain is not confirmed, as it corresponds to sterile samples only (Fig. 4).

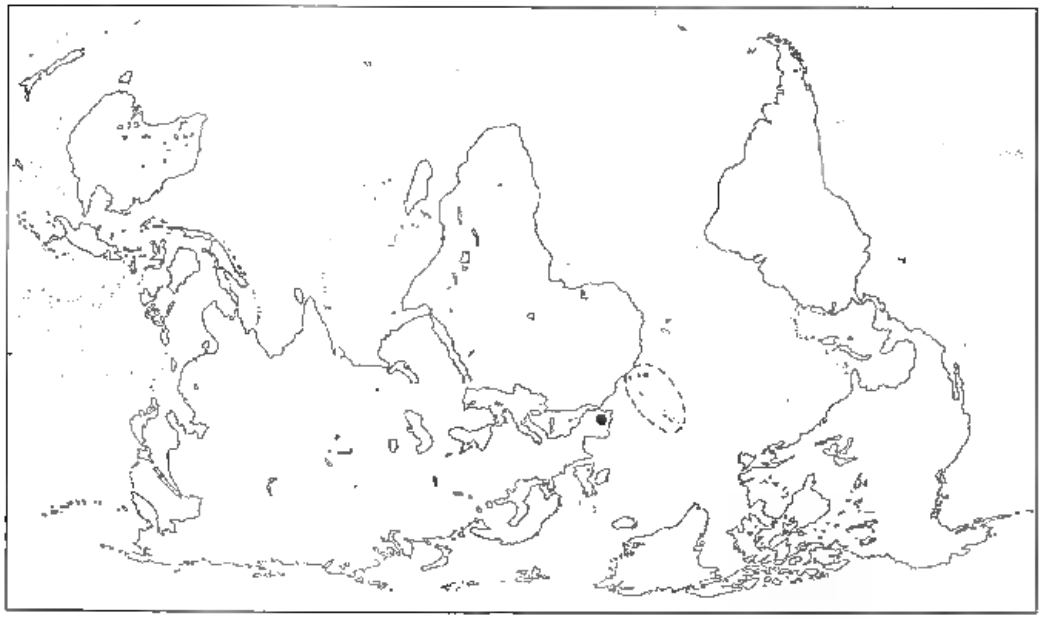

Fig. 4. - European distribution of *F. azorica*.

Representative specimens examined

Portugal- Beira Alta, Serra da Estrela, 1915-1910, *Luisier*, LISU 53198.
Azores- Terceira, Praia da Vitória, 1991.02.23, *Gabriel & Borges*, LISU 156111.
Madeira- Entre os Prazeres e o Paul do Mar, BB9225, 550 m, 1992.11.03, *Sérgio et al.* 7856, LISU, MADJ 2369; Entre Lombada dos Cedros e S. João, BB9228, 670 m, 1990.10.13, *Sim-Sim et al.*, LISU 156115; Prazeres, Lombo do Coelho, BB9326, 650 m, 1990.10.10, *Sim-Sim et al.*, LISU 156117; Prazeres, próximo de Ribeira Seca, BB9426, 620 m, 1990.10.10, *Sim-Sim et al.*, LISU 156116; Deserta Grande, subida da doca, CA59, 1984.05.17, *Nóbrega*, LISU; Levada dos Piornais, Ribeira dos Socorridos, CB0034, 200 M, 1990.02.22, *Fontinha*, MADJ 1809; Seixal, Chão da Ribeira, CB0231, 450 m, 1982.12.01, *Nóbrega*, MADJ 956, LISU; Ribeira de João Delgado, Lombinho do Seixal, CB0430, 1 000-1 200 m, 1988.07.13, *Nóbrega*, MADJ 952; Entre Ribeira do Inferno ■ Espigão de S. Vicente, CB0630, 500-600 m, 1989.01.31, *Nóbrega*, MADJ 1463; Ribeira Grande de S. Vicente, CB1326, 800 m, 1989.07.18, *Fontinha*, MADJ 1566; Boaventura, Sítio do Silveira, CB1632, 250 m, 1990.04.26, *Fontinha*, MADJ 2000; Levada dos Tornos, Palheiro Ferreiro, CB2018, 600 m, 1989.10.10, *Fontinha*, MADJ 1696; Engenho Velho de S. Jorge, CB2233, 1990.10.12, *Sim-Sim et al.*, LISU 156114; Casa do Sardinha, CB4223, 100 m, 1990.01.15, *Sérgio & Sim-Sim*, LISU 156112; Porto Santo, Pico do Facho, CB3621, 300 m, 1990.10.09, *Sim-Sim & Sérgio*, LISU; Porto Santo, Pico Castelo, CB7560, 350 m, 1990.10.27, *Sim-Sim et al.*, LISU 156121.

Canary Islands- Gran Canaria, 1989.03.18, *Dirkse 6902*; Gran Canaria, 1989.03.30. *Dirkse* 6966; Fuerteventura, 1992.02.17, *Dirkse* 6900.

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Source : MNHN, Paris

GYPSIFEROUS OUTCROPS IN SE SPAIN, REFUGES OF RARE, VULNERABLE AND ENDANGERED BRYOPHYTES AND LICHENS

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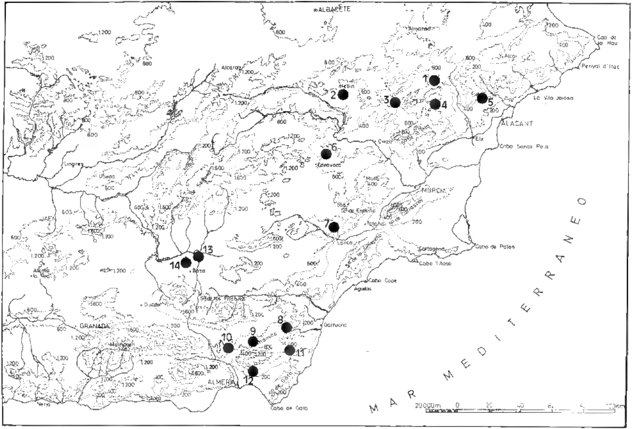
ABSTRACT - After studying the bryophyte and lichen flora of the gypsiferous outcrops of SE Spain, it is becoming clear that these sites are important as a refuge for rare, vulnerable and endangered species. Twenty one bryophyte taxa and 17 lichen taxa, about 20% of the total bryophyte and lichen flora, are rare or endemic species, which live exclusively or almost exclusively on gypsiferous substrates. It is proposed that 14 areas should be protected since all of these species grow there. Finally the different impacts that affect these outcrops in the SE of Spain are analysed.

RESUMEN - Tras un prolongado estudio realizado sobre la flora briológica y liquénica de los afloramientos yesíferos del sudeste de la Península Ibérica, se llega a la conclusión de que éstos resultan ser importantes refugios para especies raras, amenazadas y en peligro de extinción. Veintiuna especies de briófitos y 17 de líquenes, alrededor del 20% de la flora brio-liquénica de estos territorios, son especies raras o endémicas que viven, casi o exclusivamente, en sustratos yesíferos. Se proponen 14 áreas que deberían ser protegidas para conservar estas especies y se analizan, por último, los impactos más frecuentes que afectan estos hábitats.

KEY WORDS: Bryophytes, Lichens, southeast Spain, gypsiferous soils, threatened species.

INTRODUCTION

The most important gypsiferous outcrops of Spain coincide more or less with the great Tertiary depressions. These are the outcrops of Duero, Ebro and Tajo, of which the last two are quite similar from a floristic point of view. Another very important outcrop reaches, almost without interruption, from the coast of Almería to the interior region of the depression of Baza (province of Granada). Other, less extensive outcrops can be found in the provinces of Murcia, Albacete and Alicante. During the Miocene a great transgression of the Mediterranean Sea took place, invading many parts of the Mediterranean coast and connecting the Mediterranean broadly with the Atlantic Ocean. The later regression in the same period caused a crisis of salinity in the Mediterranean Sea, since it left behind isolated or poorly communicating basins. In



Source : MNHN, Paris

these hypersaline basins the deposition of gypsum and other evaporite stone ocurred, since the water evaporated and the salts precipitated. This is the origin of the numerous gypsiferous outcrops of southeast Spain. The largest ones and those with the major floristic importance are shown in Figure 1.

The dominant vegetation is formed by open scrub and thyme formations that grow on haplic gypsisols and petrogypsic gypsisols (FAO-UNESCO 1988). Numerous species of chamaephytes and nanophanerophytes that form these scrubs are endemic in these zones, for example *Helianthemum squamatum* (L.) Dum. Cours, *Lepidium subulatum* L., *Ononis tridentata* L., *Helianthemum alypoides* Losa & Rivas Goday, *Teucrium balthazaris* Sennen and *Herniaria fruticosa* L.. The annual precipitation of these regions, which are situated in the thermomediterranean or mesomediterranean belt (cf. Rivas-Martínez 1988) is the lowest of the Iberian Peninsula, reaching from 200 to 300 mm. This gives a semiarid ombroclimate.

During the last eight years we have studied the bryophyte and lichen flora of southeast Spain. This area includes the gypsiferous outcrops and supports the major biodiversity in arid zones of the Iberian Peninsula in respect of bryophytes and lichens. More than 100 bryophyte and 80 lichen taxa have been identified (cf. Ros & Guerra 1987, Martínez-Sánchez *et al.* 1991, Guerra *et al.* 1990, 1992, 1993a, 1993b, Casares & Gutiérrez-Carretero 1993). In this article we want to show the importance of the gypsiferous outcrops of the spanish SE as refuges of the rare bryophyte and lichen species that will be listed below. In order to indicate the degree of danger to which the species are exposed in their habitats, we use the categories proposed by the IUCN: rare (R), vulnerable (V) and endangered (E). Furthermore we take in consideration the observations made by Schumacker (1992).

RESULTS

Bryophytes

Acaulon casasianum Brugués & Crum - Described from gypsiferous soils of the NE of the Iberian Peninsula (Brugués & Crum 1984), its presence in the gypsiferous areas of SE Spain confirms its clear preference for soils of this type. Not known from outside the Iberian Peninsula or from other types of substratum, it can be considered an Iberian endemic. (V).

Figure 1. Geographic situation of the gypsiferous outcrops. 1: Villena (Alicante), XH8274, DM. 2: Agramón (Albacete), XH2060, SM. 3: Cerro de la Rosa (Murcia), XH5555, SM. 4: Pinoso (Alicante), XH7350, SM. 5: Campello (Alicante), YH0671, ST. 6: Cañara (Murcia), XH0820, SM. 7: Lorca (Murcia), WH9402, SM. 8: Sorbas-Los Castaños (Almería), WG7903 and WG8409, ST. 9: Venta Los Yesos (Almería), XG6203, SM. 10: Yesoncillo de Enmedio (Almería), WG4300, ST. 11: Cerro de las Cuevas (Almería), WF8498 and WF8697, ST. 12: Cuevas de los Medinas (Almería), WF6283, ST. 13: Galera (Granada), WG3976, DM. 14: Benamaurel (Granada), WG3069, DM. Biocliomatic belt: DM=dry mesomediterranean, SM=semiarid mesomediterranean, ST=semiarid thermomediterranean.

Acaulon dertosense Casas, Sérgio, Cros & Brugués - Described from Catalonia (Spain) (cf. Casas *et al.* 1986), this is a relatively frequent species found on almost all of the gypsiferous soils studied in the SE of Spain. Its distribution in the Iberian Peninsula is not well known yet, but it appears at various localities of the Spanish east coast, from Tarragona to Almería. It can be considered an Iberian endemic which shows a clear preference of loamy-gypsiferous soils. (R).

Aloina bifrons (De Not.) Delg. - This is a species with a poorly known distribution in Europe, probably due to its rarity (cf. Düll 1984), although there are more precise data concerning its presence in Asia Minor, South Africa and North America. In the Iberian Peninsula it can be found frequently, but only on dry gypsiferous or loamy-gypsiferous soils, especially in SE regions with an arid or semiarid ombroclimate. (R).

Crossidium aberrans Holz. & Bartr. - Discovered in Europe by Ros & Guerra (1986) on gypsiferous soils, this species has later been recorded from various points in the Iberian Peninsula, but almost every time on gypsiferous or loamy-gypsiferous soils. In the rest of Europe it is known only in France (cf. Pierrot 1986). (R).

Crossidium laevipilum Thér.& Trab. - Known from the N of Africa (Thériot 1931), Israel, Jordan (Frey & Kürnschner 1991a) and in Europe from the Iberian Peninsula (Cano *et al.* 1993, Casas *et al.* 1993). In the spanish SE it grows on gypsiferous soils of the most arid zones. (R).

Crossidium seriatum Crum & Steere - Up to now this species is only known from the American Continent (cf. Crum & Steere 1958, Zander 1977, Stark & Whitemore 1992) and from the Iberian Peninsula, where it is frequent on gypsiferous soils in somewhat continental areas of southeast Spain (cf. Cano *et al.* 1992). (R).

Didymodon aaronis (Lor.) Guerra - An Irano-Turanian species, known from Israel, Jordan, Iran, Iraq and Egypt (cf. Agnew & Townsend 1970, Agnew & Vondracek 1975, Frey & Kürschner 1983). In Europe it is only known from the provinces of Murcia, Alicante (unpublished) and Almería, in SE Spain. It has always been found on gypsiferous or loamy-gypsiferous substrates that are more or less nitrogen-enriched (cf. Guerra & Ros 1987). (R).

Enthostodon hungaricus (Boros) Loeske - A species recorded from the steppes of eastern Europe (Boros 1924) and from Israel (Herrnstadt *et al.* 1991). It presents a disjunction in the Iberian Peninsula. It is found exclusively on saline soils in gypsiferous depressions or near saline lagoons. It is known from Los Monegros (Casas & Brugués 1978), from Las Bárdenas (Fuertes & García-Gómez 1981), from south of Madrid (Brugués & Cros 1986) and from the SE of the Iberian Peninsula in the Provinces of Alicante (cf. Guerra *et al.* 1989) and Granada (unpublished). (E).

Grimmia mesopotamica Schiffn. - Known from Israel, Jordan, Iraq (Frey & Kürschner 1991b) and from the Republic of Turkmenia (former USSR) (Abramova & Abramov 1988). In Europe it has been found at one site at Almería (Spain), where it colonizes rocks and slopes of gypsum under a semiarid climate (cf. Guerra *et al.* 1993a). (V).

Gymnostomum lanceolatum Cano, Ros & Guerra - Up to now only known from the Iberian Peninsula, it occurs at various sites at Almería and Alicante (cf. Cano *et al.* 1994a). It grows on gypsiferous slopes protected by chamaephytes. (R).

Phascum cuynetii Biz. & Pierrot - Only known from the SE of the Iberian Peninsula (Alicante and Almería) (cf. Bizot *et al.* 1970, Guerra *et al.* 1991), this species can at present be considered an Iberian endemic. It is a terricolous species with a clear preference for loamy and gypsiferous soils. (V).

Phascum longipes Guerra, Martínez & Ros - An Iberian endemic described by Guerra *et al.* (1990) from gypsiferous outcrops of the province of Almería. One other locality in the NE of Spain is known (unpublished). (V).

Phascum piptocarpum Dur. & Mont. in Mont. - This species is known only from one site in north Africa (Montagne 1856), from another site in the SE of the Iberian Peninsula (cf. Guerra *et al.* 1991), and from recent records in Catalonia (cf. Brugués *et al.* 1993). It grows on gypsiferous and saline soils that are temporarily wet, localized in depressions between gypsiferous hills. (V).

Phascum vlassovii Laz. - A very rare species, only known from localities in Armenia, Ukraine, Central Asia (cf. Lazarenko 1938, Savicz-Ljubitzkaja & Smirnova 1970), Turkey (Cetin 1988), British Columbia (McIntosh 1989) and the Iberian Peninsula (Guerra *et al.* 1991, Brugués *et al.* 1993). In SE Spain it appears on gypsiferous or saline soils localized in depressions between gypsiferous hills. (V).

Pottia pallida Lindb. - A circum-mediterranean species, also present on the Canary Islands (cf. Guerra & Ros 1988). It is a rare species, which is restricted to saline soils, either in depressions between gypsiferous hills or at the margin of saline lagoons. In both cases it may colonize considerable surfaces of bare soil between higher plants that are temporarily inundated (Guerra *et al.* 1989). Because of its special ecological behaviour the saline sites where it grows should be protected. (E).

Pterygoneurum compactum Cano, Guerra & Ros - A very rare species, which is only known from the Iberian Peninsula (one site in Lérida and one other in Alicante) (cf. Cano *et al.* 1994b). In both cases it grows on dry, exposed gypsiferous or saline soils. (R).

Pterygoneurum crossidioides Frey, Herrnstadt & Kürschner - A species known from the desert areas near the Dead Sea (cf. Frey *et al.* 1990), it has recently been found by us on gypsiferous soils in the province of Albacete. No other European locality is known. (V).

Pterygoneurum sampaianum (Mach.) Mach. - First described from chalky clay in the Algarve (cf. Machado 1925), this taxon has been little studied due to its rarity. Nevertheless it is relatively frequent on gypsiferous or saline soils in the SE of the Iberian Peninsula (Almería, Albacete and Murcia). It is also present in central and NE Spain, showing the same ecological preferences. It has not been recorded outside the Iberian Peninsula. (V).

Riccia crustata Trabut - A circum-mediterranean species, which lives on gypsiferous and saline soils. In the SE of the Iberian Peninsula it colonizes considerable areas in clearings, in scrub and in saline depressions between gypsiferous hills, where it grows with *Pottia pallida, Enthostodon hungaricus, Pterygoneurum sampaianum* and *Phascum piptocarpum*. All these species are mentioned in this list of rare or endangered species, emphasizing the enormous importance of conserving the gypsiferous and saline areas. (V).

Tortula brevissima Schiffn. - Described by Schiffner (1913) from the Middle East, this species has later been recorded from France, Switzerland, Germany (cf. Boudier 1988, Reimers 1941) and various sites of the Iberian Peninsula. In Europe it can generally be considered a rare taxon, but it is quite frequent on the gypsiferous outcrops in the SE of the Iberian Peninsula. (R).

Tortula caninervis (Mitt.) Broth. subsp. ***spuria*** (Amman) W. Kramer var. ***spuria*** - Recorded from some Middle Eastern countries (Afganistan, Iran, Iraq, Turkey) and from Ukraine and Central Europe (Czechoslovakia and Switzerland), this species is known in the Iberian Peninsula only from one site in Catalonia (Brugués *et al.* 1993), Almería (cf. Martínez-Sánchez *et al.* 1991) and Alicante (Moya *et al.* 1994). (R).

Lichens

Acarospora clauzadeana (Llimona) Casares & Hafellner - Described from Almería (Spain) as *Biatorella clauzadeana* (cf. Llimona 1974), this species has recently been placed in *Acarospora* (cf. Hafellner & Casares-Porcel 1992). It grows exclusively on saccharoide or cristalline gypsum. Although previously considered an Almerian endemic, it has recently been found in North America (Mexico and New Mexico) (cf. Weber & Nash 1992). (V).

Acarospora placodiiformis H. Magn. - An Ibero-Maghrebian species present in thermo- and mesomediterranean gypsiferous soils. At the hottest sites it appears rarely and then with few fructifications.(V).

Buellia almeriensis Llimona - Described from the SE of the Iberian Peninsula (cf. Llimona 1974), it appears on hardened crusts of gypsum. Up to now its only known sites are in the province of Almería (Spain) and Morocco (cf. Casares-Porcel *et al.* 1994). (E).

Buellia heliophylla Llimona - Described by Llimona (1974) from Venta de los Yesos (Almería, Spain), it seems to be a very rare species, since no other populations have yet been found. It grows exclusively on gypsum. (E).

Buellia zoharyi Galun - Although it was described from the Negev Desert in Israel on loess soils (cf. Galun 1970), it seems to be much more frequent in the Iberian Peninsula, where it grows almost always on gypsum. Recently, it has been recorded as new to Africa (cf. Casares-Porcel *et al.* 1994), growing on gypsiferous soils. Its distribution shows a remarkable disjunction between the eastern and western extremes of the Mediterranean region. It is common on gypsiferous soils of SE Spain. (R).

Collema coccophorum Tuck. - There are scattered records from Australia, North and South America, Africa and Europe. This species is limited to bare chalky or gypsiferous soils (cf. Degelius 1954, 1974). In the Iberian Peninsula it is frequent on gypsiferous soils, especially in the SE. It has been included in the Red Data Book of macrolichens of the European Community. (R).

Diploschistes ocellatus (Vill.) Norm. var. ***almeriense*** Llimona - A taxon described by Llimona (1974) growing on gypsiferous crusts at some sites in Almería. It may be considered an exclusively Almerian endemic. (E).

Fulgensia desertorum (Tomin) Poelt f. ***macrospora*** Llimona - A taxon known only from the SE of the Iberian Peninsula and Morocco (cf. Casares-Porcel *et al.* 1994) where it is frequent on gypsiferous outcrops. (V).

Fulgensia poeltii Llimona - Described by Llimona (1974) from the gypsiferous outcrops of Almería, this species is frequent on the principal gypsiferous outcrops of Spain. It can be considered an Ibero-Maghrebian species with an exclusively gypsicolous habitat. (V).

Lecidea circinarioides Casares & Hafellner ad. int. - A very frequent species on saccharoide or crystalline gypsum, it resembles species of the genus *Aspicilia*, which has led some authors to confuse it with *A. contorta* (Hoffm.) Krempelh. subsp. *hofmanniana* Ekman & Froberg. It is an exclusive gypsophyte and can be considered and Ibero-Maghrebian species. (V).

Lecidea gypsicola Llimona - Frequent on the mesomediterranean gypsiferous outcrops, it was described by Llimona (1974) from gypsum in the river Ebro valley. Its area shows a disjunction with Central Asia (Tadzikistan) where it has been collected by Hertel (1977). It reaches the gypsum of the depression of Baza but is absent from Almería. (R).

Lepraria crassissima (Hue) Lettau var. ***isidiata*** Llimona - Always present on shaded slopes with gypsum dust in the principal gypsiferous outcrops of the Iberian Peninsula. It is an Ibero-Maghrebian taxon which is especially abundant in the Iberian SE. (V).

Llimoniella scabridula (Müll. Arg.) Navarro-Rosinés & Hafellner - A lichenized fungus described from the Swiss Valais, its only known sites are the type locality and the gypsiferous outcrops of the Iberian Peninsula (Hafellner & Navarro-Rosinés 1993, Gutiérrez & Casares 1994). (R).

Placidiopsis tenella (Nyl.) Zahlbr. - A very rare species known from some sites in Algeria. The only European record is from the gypsum of Almería (cf. Gutiérrez & Casares 1994). (R).

Psora saviczii (Tomin) Follm. & Crespo - Known from Ukraine, where it was first described, Morocco and the gypsum outcrops of the Iberian Peninsula. It represents an interesting floristic disjunction and is abundant in the SE of the Iberian Peninsula. (R).

Rhizocarpon malenconianum (Llimona & Werner) Hafellner & Mayrhofer - Always epiphytic on the thallus of *Diploschistes diacapsis* (Ach.) Lumbsch, this is one of the

most characteristic species on gypsum. Its distribution is poorly known. In Spain it is rectricted to gypsiferous areas and is frequent in SE. It has been recently recorded in North Africa (cf. Casares-Porcel *et al.* 1994) (R).

Teloschistes lacunosus (Rupr.) Sav. - A terricolous or semivagrant species that is disjunct between the Irano-Turanian territories and the Iberian Peninsula. It is especially abundant in the gypsiferous areas of SE Spain. (R).

THREATS AND APPROACHES TO CONSERVATION

Practically all the sites shown in Figure 1 are subject to the extraction of gypsum. Therefore the sites are affected by the construction of roads, and by contamination of the soil and air by dust produced by the heavy machinery used at the quarries. Today the ploughing of these sites for agriculture forms another threat, which is difficult to understand since these areas support little agricultural production. In many of sites there are illegal deposits of rubbish from nearby villages, that cause considerable nitrification of the soils. From all of the areas shown in Figure 1 only three, in the province of Almería, are included in the Catalogue of Natural Protected Sites of the Environment Protection Agency of the local government of Andalusia. All the other sites are unprotected, in spite of their being known by the scientific community of Spain as important zones for endemics and as refuges for rare and endangered species. If all these gypsiferous areas (Fig. 1) were considered Natural Sites, the threats to bryophyte and lichen species could be eliminated or at least controlled, thus saving the species from possible extinction.

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Source : MNHN, Paris

COMUNIDADES LIGNÍCOLAS DEL SECTOR CENTRAL DE SIERRA MORENA (SW DE ESPAÑA)

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ABSTRACT - The lignicolous communities of central Sierra Morena (SW of Spain) are studied, remarks on their chorology and ecology are given. The association *Buellietum cedricolae* ass. nov. is described.

RÉSUMÉ - Les auteurs présentent les communautés lignicoles du centre de la Sierra Morena (SW Espagne) des points de vue écologique et chorologique. Le *Buellietum cedricolae* ass. nov. est décrit.

RESUMEN - Se estudian las características corológicas y ecológicas de las comunidades lignícolas que aparecen en el sector central de Sierra Morena (SW de España). Se describe la asociación *Buellietum cedricolae* as. nov.

INTRODUCCIÓN

Durante el estudio sobre flora liquenológica que estamos realizando en el sector central de Sierra Morena, hemos detectado la presencia de biocenosis lignícolas frecuentes en el interior de los bosques. Estas comunidades aparecen sobre la madera caída en descomposición y los restos de ramas y tocones allí dispersos.

El sector central de Sierra Morena discurre por las provincias de Ciudad Real, Córdoba y Jaén. En su conjunto tiene escasa altitud ya que raramente sobrepasa los 1300 m. El sustrato geológico está constituido por materiales silíceos en su mayor parte. El clima es mediterráneo templado subhúmedo con una notable influencia atlántica, debida a los vientos húmedos dominantes del S y SW. La zona estudiada se sitúa en los pisos Mesomediterráneo y Supramediterráneo del subsector biogeográfico Marianense (sector Mariánico-Monchiquense, provincia Luso-Extremadurense, región Mediterránea) (Rivas-Martínez 1987). La vegetación vascular dominante está formada por encinares, alcornocales y melojares mesomediterráneos en general bastante aclarados ya que se dedican al pastoreo vacuno y la explotación de éstos bosques es en forma de dehesas. También aparecen pequeñas extensiones de melojares supramediterráneos con un estado de desarrollo más favorable.

Los estudios anteriores de este tipo de comunidades en la Península Ibérica son muy dispersos. Sólo existen datos de Cataluña (Alvaro-Martín & Hladun-Simón 1983), Albacete (Egea *et al.* 1985) y norte de Navarra (Etayo 1990).

RESULTADOS Y DISCUSIÓN

En el conjunto de las formaciones vasculares de Sierra Morena hemos observado las siguientes biocenosis lignícolas (Fig. 1):

- **Sobre troncos y tocones de fagáceas**. Las maderas de *Quercus pyrenaica* Willd. y *Q. faginea* Lam. subsp. *broteroi* (Coutinho) A. Camus son bastante blandas por lo que se descomponen con facilidad, incrementando rápidamente su acidez y la capacidad de retención de agua. Las comunidades que se instalan en este tipo de madera poseen un dinamismo más o menos rápido dependiendo principalmente del grado de descomposición de la madera.

1.- Sobre las áreas laterales descortezadas de tocones, se instalan comunidades muy empobrecidas en especies características, formadas por recubrimientos casi monoespecíficos, de talos de *Calicium glaucellum* Ach., *C. salicinum* Pers., *Mycocalicium victoriae* (C. Knight ex F. Wilson) Tibell y *M. subtile* (Pers.) Szat. La fisiognomía de estas comunidades está caracterizada por los talos endofleódicos blanquecinos y amarillentos que cubren amplias superficies.

Mycocalicium subtile y *Calicium salicinum* tienen una amplia distribución en la Península Ibérica, mientras que *Mycocalicium victoriae* y *Calicium glaucellum* tienen una distribución muy restringida (Sarrión *et al.* 1993). Estas comunidades, hasta no poseer mas datos biogeográficos pueden incluirse provisionalmente en la as. *Calicietum glaucelli*.

2.- En los restos de madera menos inclinados y más descompuestos aparecen comunidades de briófitos y líquenes pertenecientes a la as. *Cladonietum coniocraeae*.

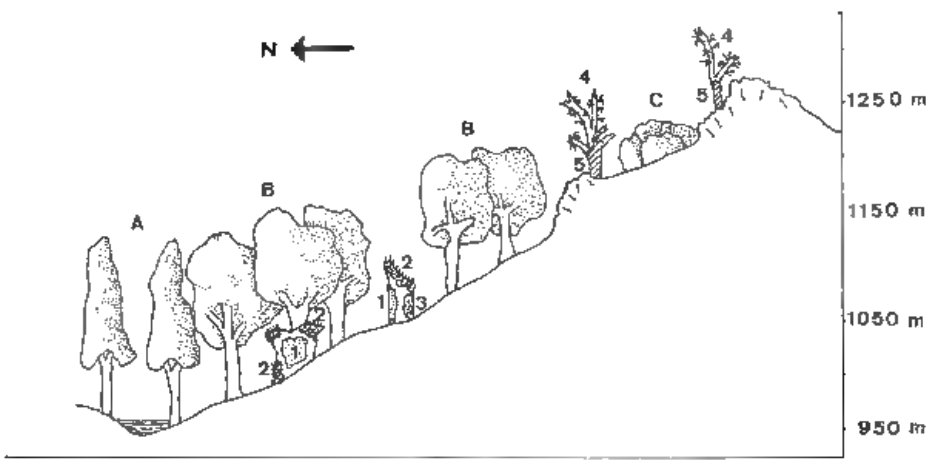

Fig. 1.- Situación de las comunidades lignícolas en la Sierra de Dormideros. 1- *Calicietum glaucelli*, 2- *Cladonietum coniocraeae*, 3- *Lecanorion variae*, 4- *Pseudevernietum furfuraceae*, 5- *Buellietum cedricolae*. Formaciones vasculares: A) alisedas (*Scrophulario scorodoniae-Alnetum glutinosae* Br.-Bl., P. Silva & Rozeira 1956), B) melojares (*Arbuto unedonis-Quercetum pyrenaicae* (Rivas Goday 1959) Rivas Martínez 1987), C) matorral de cumbres (*Adenocarpetum argyrophylli* Rivas Martínez & Belmonte inéd.).

Se caracterizan por la abundancia de talos de *Cladonia* (*C. coniocraea* (Flörke) Sprengel, *C. fimbriata* (L.) Fr., *C. macilenta* Hoffm., *C. phyllophora* Hoffm., *C. ramulosa* (With.) Laundon y *C. squamosa* (Scop.) Hoffm.) instalados sobre alfombras de musgos pleurocarpicos (*Hypnum cupressiforme* Hedw.) o directamente sobre la madera en descomposición. Estas biocenosis han sido también descritas para Cataluña (Alvaro-Martin & Hladun-Simón 1983) y Albacete (Egea *et al.* 1985).

3.- En troncos verticales más iluminados, aparecen grandes superficies recubiertas por los talos inconspicuos o verrucosos, amarillo pálido de *Lecanora varia*. Constituyen comunidades monoespecíficas y fragmentarias de biocenosis con difícil encuadre sintaxonómico pero relacionadas con la al. *Lecanorion variae*.

- **Sobre la madera muerta de enebros**. La madera de *Juniperus oxycedrus* L. posee una gran dureza, acidez y resistencia a la descomposición (su utilización tradicional ha sido en la fabricación de pozos y norias, ya que no se descomponían en el agua). En estos medios se instalan comunidades muy estables, de escaso dinamismo y pobres en especies.

4. - Las ramas más secas, finas y expuestas, están cubiertas por talos de *Pseudevernia furfuracea* var. *ceratea* y *Parmelia tiliacea*, especies consideradas características de la as. *Pseudevernietum furfuraceae* que se instalarían en estos lugares debido al pH ácido que presentan estas maderas. Esta asociación ha sido definida en numerosas areas peninsulares (Crespo 1974, Marcos-Laso 1983, Egea *et al.* 1985) pero siempre sobre forófitos vivos de *Pinus* spp.

5. - En los troncos y a veces también en las ramas más gruesas, preferentemente en exposiciones S y SE, sobre madera muerta y descortezada de enebro, hemos encontrado recientemente *Buellia cedricola* Werner que es una especie mediterráneo occidental, distribuida en el sur de España, norte de Africa y Córcega (Burgaz & Sarrión 1994).

Buellia cedricola es un elemento favorecido en parte por los vientos húmedos que llegan del Atlántico hasta estos valles orientados en dirección S y SW. Estas condiciones climatológicas tienen cierta similitud con los bosques de *Cedrus atlantica* (Endl.) Carrière del N de Africa donde fué descrita la especie, aunque las condiciones de humedad son mayores en aquellos bosques como nos indica la presencia de *Mycocalicium subtile, Calicium adspersum* Pers. y *Xylographa abietina* (Pers.) Zahlbr. conviviendo con *Buellia cedricola* (Werner 1970). En nuestro territorio, *B. cedricola* tiene un comportamiento algo diferente, se instala en zonas más secas y abiertas mientras que *Mycocalicium subtile* que también está presente en Sierra Morena, se refugia en el interior de los bosques caducifolios donde hay un mayor aporte de humedad.

Por la composición florística que presenta esta comunidad no ha sido posible encuadrarla dentro de ninguna de las asociaciones descritas hasta el momento. Por ello definimos la as. ***Buellietum cedricolae* nova** (holotipo inv. 7, Tabla 1), cuya especie característica es *Buellia cedricola*. *Pyrrhospora elabens* (Fr.) Haf., *Cyphelium tigillare* (Ach.) Ach.y *Lecanora varia* que le acompañan deben ser consideradas especies características de unidades superiores.

Buellietum cedricolae es una comunidad pobre en especies, donde aparecen además con baja abundancia talos de *Pertusaria* spp. y *Parmelia tiliacea* (Hoffm.) Ach. Acompañan también algunas especies acidófilas como *Hypogymnia farinacea* Zopf, *Pseudevernia furfuracea* var. *ceratea* (Ach.) D. Hawksw. y *Platismatia glauca* (L.) W. Culb. & C. Culb., hongos no liquenizados como *Dacrymyces* sp. y líquenes de preferencia saxícola como *Lasallia pustulata* (L.) Mérat, *Parmelia pulla* subsp. *pulla* Ach. y *P. tinctina* Mah. & Gill.

Es una comunidad lignícola, acidofítica, aeroxerofítica, anombrofítica, fotofítica y heliofítica.

Tiene una fisiognomía caracterizada por el desarrollo de los talos crustáceos de color amarillo claro, blanquecinos y grisáceos, abundantemente provistos de ascocarpos negros, sobre los que se instalan perifericamente talos grises foliáceos y fruticulosos. Esta fisiognomía es semejante a las comunidades lignícolas descritas para las Islas Canarias (La Gomera y El Hierro) creciendo sobre *Juniperus phoenicea* L. (Hernández-Padrón *et al.* 1991), sin embargo la composición florística es distinta en aquellas comunidades ya que dominan *Lecanora sabinae* Hernandéz-Padrón, Vänska & Pérez de Paz, *Pertusaria* spp., *Ochrolechia pallescens* (L.) Massal. y numerosas especies de *Ramalina*.

Buellietum cedricolae tiene una distribución preferente en los reducidos enclaves Supramediterráneos de la submeseta Sur (Fig. 2), se ha encontrado con gran

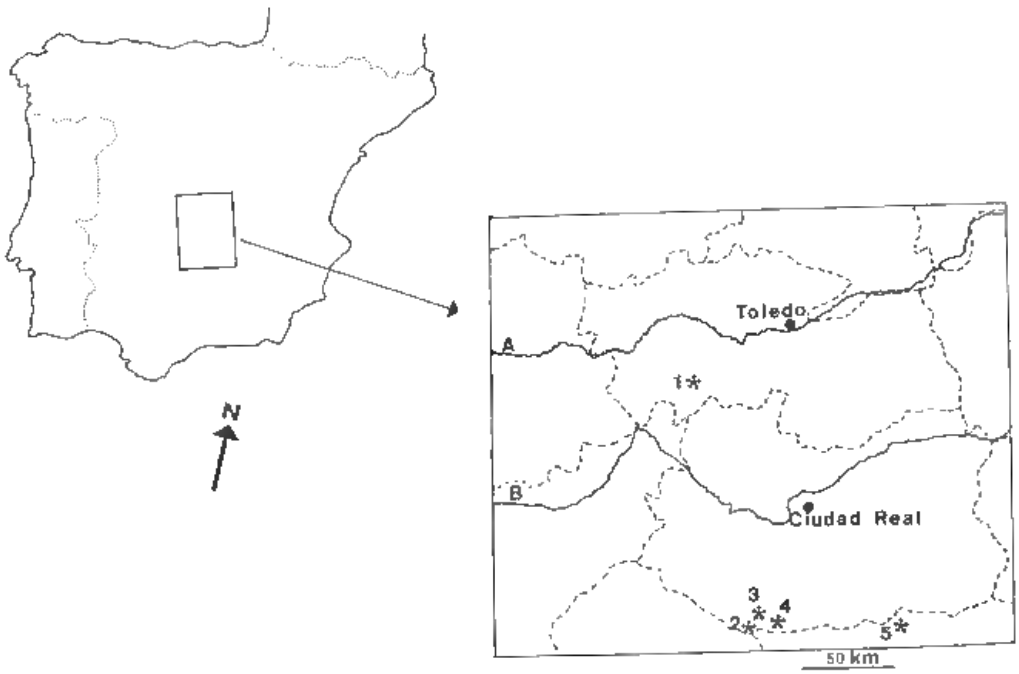

Fig. 2.- Localización del area estudiada: Límites provinciales (- - -). Localidades muestreadas: 1- Los Navalucillos. 2- Fuencaliente. 3- Sierra de Dormideros. 4- Solana del Pino. 5- Aldeaquemada. A- Río Tajo. B- Río Guadiana.

Tabla 1.- *Buellietum cedricolae* as. nova Holosyntypus inv. nº 7

Altitud (m)	1010	1015	870	1180	1180	1195	1220	1250	650	700
Forófito	Jo	Jo	Jo	Jo	Jo	Jo	Jo	Jo	Jo	Jo
Altura sobre el suelo (cm)	140	200	180	176	100	70	55	40	130	70
Diámetro del tronco (cm)	5	20	15	30	35	20	40	30	10	15
Exposición	NE	N0	NO	O	SO	S	SE	SE	SE	SE
Inclinación (°)	10	85	30	80	70	85	60	90	10	90
Cobertura (%)	70	50	90	70	80	95	100	100	50	70
Area (dm^2)	0.4	3	2	3	2	2	1.6	6	1.5	1.5
Número de especie	4	4	11	5	6	6	5	13	5	10
Número de orden	1	2	3	4	5	6	7	8	9	10
Características asociación:										
Buellia cedricola	3.3	3.4	4.4	3.4	4.4	2.3	2.3	1.2	2.3	2.3
Caract. unidades superiores:										
Pyrrhospora elabens	3.2	1.2	+.1	+.1	+.1	.	2.2	+.1	.	.
Cyphelium tigillar	.		+.2	.	.	+.1	2.3	1.2	.	.
Lecanora varia	.	.	.	.	.	.	+.2	2.3	+.1	2.3
Compañeras:										
Parmelia tiliacea		.	+.2	1.2	+.2	1.3	.	+.2	2.2	1.3
Parmelia saxatilis	+.1	+.1	.	.	.	.	.	.	.	.
Parmelia tinctina	.	.	.	.	.	.	.	1.1	.	+.1
Pseudevernia furfuracea var. *ceratea*	.	+.2	+.2	2.2	+.2	.	+.2	+.2	.	.
Pertusaria flavida	.	.	+.1	1.1	+.1	3.3	.	.	+.1	+.1
Pertusaria pertusa	.	.	+.1	.	.	1.2	.	+.1	.	.
Pertusaria amara	.	.	+.2	.	.	2.3	.	.	1.1	.
Calicium parvum	.	.	+.1	.	.	.	.	.	.	+.1
Lasallia pustulata	.	.	.	.	.	.	.	+.2	.	+.1
Hypocenomyce scalari	.	.	+.2	.	.	.	.	.	.	+.2

Además: *Parmelia somloensis* +.1, en 1; *Hypogymnia farinacea* 2.2, en 3; *Amandinea punctata* 2.3 en 5; *Parmelia sulcata* +.2, *P. pulla* subsp. *pulla* +.2, *Platismatia glauca* +.2 en 8; *Micarea bauschiana* 2.3, *Ramalina polymorpha* subsp. *capitata* +.2 en 10.

Jo: *Juniperus oxycedrus* L.

Localidades: 1, 2 y 3, Valle del Río Chorro (29S UJ57), Los Navalucillos, Toledo. 4, 5 y 6, Sierra de Dormideros (30S UH95), Ciudad Real. 7 y 8, Fuencaliente (30S UH85), Sierra Madrona, Ciudad Real. 9, Hoz del Río Montoro (30S VH06), Solana del Pino, Ciudad Real. 10, La Cimbarra (30S VH65), Aldeaquemada, Jaén.

frecuencia y abundancia en las crestas cuarcíticas de Sierra Morena y recientemente en los Montes de Toledo, donde los fuertes vientos y la insolación ocasionan cierta desecación sobre los troncos muertos. En el piso Mesomediterráneo aparece puntualmente y más empobrecida en especies.

Las exigencias ecológicas de esta asociación se ajustan más a los requerimientos de las biocenosis incluidas en la al. *Lecanorion variae* (fuertemente acidofítica, aeroxerofítica y ombrofítica) en fuerte contraste con las asociaciones de la al. *Calicion viridis* (fotofítica, heliofítica y toxitolerante) (Barkman 1958) y con las otras alianzas que incluyen comunidades lignícolas de biotipo crustáceo.

La presencia de *Lecanora varia* (Hoffm.) Ach. y *Cyphelium tigillare* en estas biocenosis es problemática. Barkman (1958) considera a *Cyphelium tigillare* especie característica de *Xylographetum parallelae* (= *Cyphelietum tigillaris*) perteneciente a la al. *Calicion viridis*.

James *et al.* (1977) señalan que la as. *Cyphelietum inquinantis* (comunidad con gran abundancia de *Cyphelium inquinans* (Sm.) Trevisan, *Lecanora varia* y *Parmeliopsis ambigua* (Wulfen) Nyl.) posee grandes afinidades con la al. *Calicion viridis*, pero en nuestro caso la presencia de *Lecanora varia* y la ausencia de *Cyphelium inquinans* y *Parmeliopsis ambigua* no nos permite incluir nuestros inventarios en esta comunidad. Iguálmente señalan estos autores que la as. *Cyphelietum tigillaris* está poco definida.

Wirth (1980) considera que *Cyphelium tigillare* crece frecuentemente con *Lecanora varia, Xylographa vitiligo* (Ach.) Laundon y *Calicium trabinellum* (Ach.) Ach. incluyendo este conjunto de especies en la as. *Xylographetum vitiliginis* dentro de la al. *Lecanorion variae*, pero la ausencia de *Xylographa vitiligo* y *Calicium trabinellum* en el sur de la Península Ibérica no nos permite incluir nuestras biocenosis en esta asociación. Hasta el momento *Xylographetum vitiliginis* sólo se ha citado sobre tocones de *Pinus uncinata* Ramond ex DC. en el Pirineo navarro (Etayo 1990).

La ausencia de *Lecanora symmicta* (Ach.) Ach. en nuestros inventarios tampoco nos permite considerar estas biocenosis pertenecientes a la as. *Lecanoretum symmictae* descrita por Klement (1956).

La presencia de *Lecanora varia* en nuestros inventarios nos induce a incluir la as. *Buellietum cedricolae* dentro de la al. *Lecanorion variae*, siguiendo los criterios de James *et al.* (1977) y de Wirth (1980). Consideramos que la aparición de *Cyphelium tigillare* y *Pyrrhospora elabens* en esta comunidad es un indicador del aumento de la continentalidad que soportan los enebros (*Juniperus oxycedrus*) situados a mayor altitud que los bosques de fagáceas en la submeseta sur de la Península Ibérica.

Pyrrhospora elabens tiene una distribución disyunta, aparece en USA, Australia, Japón y Europa. En Europa tiene preferentemente un comportamiento artico-alpino pero también se extiende hasta Cerdeña y la mitad sur de la Península Ibérica (Hafellner 1993). *Cyphellium tigillare* presenta una distribución circumboreal, en Europa se extiende por Escandinavia, Islas Británicas y las montañas del centro y sur (Nimis 1993).

ESQUEMA SINTAXONÓMICO

Leprarietea candelaris Wirth 1980
Leprarietalia candelaris Wirth 1980 (= *Leprarietalia* Barkm. 1958 em. Wirth 1972, non *Leprarietalia* Hadac 1944)
Calicion viridis Cern. & Hadac 1944
Calicietum glaucelli Kalb 1966 corr. Wirth 1980
Xylographetum paralellae Smarda 1940 (= *Cyphelietum tigillaris* Klem. 1955)

Cladonio-Lepidozietea Jezek & Vondr. 1962
Lophocoletalia heterophyllae Barkm. 1958
Cladonion coniocraeae Duvign. 1942
Cladonietum coniocraeae Frey 1927 ex Frey 1959

¿Clase?
Lecanorietalia variae Barkm. 1958
Lecanorion variae Barkm. 1958
Xylographetum vitiliginis Kalb 1970
Cyphelietum inquinantis Kalb 1970
Buellietum cedricolae ass. nova
Lecanoretum symmictae Klem. 1953

Hypogymnietea physodis Follm. 1974
Hypogymnietalia physodo-tubulosae Barkm. 1958
Pseudevernion furfuraceae (Barkm. 1958) James *et al.* 1977
Pseudevernietum furfuraceae Hil. 1925

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ADICIONES A LA FLORA BRIOFÍTICA DEL SUDESTE DE ESPAÑA

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RESUMEN - Se da cuenta del hallazgo en las provincias de Alicante y Almería de 25 táxones de briófitos interesantes. Los más importantes por ser novedad para el sudeste de la Península Ibérica se mencionan en el resumen en inglés. Se aportan datos sobre su corología y ecología.

Palabras claves: Corología, briófitos, Alicante, Almería, SE España.

ABSTRACT - Twenty five species of bryophytes are reported from the Alicante and Almería provinces. Some are new records for the SE of the Iberian Peninsula: *Cynodontium bruntonii, Ditrichum cylindricum, Philonotis tomentella, Plagiothecium succulentum, Pottia recta, Riccia sommieri, Scapania calcicola* and *Schistidium flaccidum*. Data about their chorology and ecology are given.

Key words: Chorology, bryophytes, Alicante, Almería, SE Spain.

INTRODUCCIÓN

Siguiendo la línea de investigación sobre la brioflora del sudeste de España, se han prospectado intensamente durante los últimos años las provincias de Alicante y Almería. El resultado ha sido el hallazgo de numerosos táxones interesantes por tratarse de nuevas citas para la zona, ampliando de esta forma su distribución.

La nomenclatura utilizada para musgos ha sido mayoritariamente la de Corley *et al.* (1981), la de Casas (1991) para los taxones infraespecíficos y Grolle (1983) para hépaticas. Todas las muestras están depositadas en el herbario del Departamento de Biología Vegetal (Botánica) de la Universidad de Murcia (MUB).

RELACIÓN DE TAXONES

MUSGOS

Aloina bifrons (De Not.) Delg.

Alicante: Carretera Pinoso-Fortuna, km 23-24 (Pinoso), XH7050, 550 m. En suelos salinos ligeramente nitrificados. Se trata de una especie relativamente frecuente

en el sudeste español, casi siempre asociada a suelos yesíferos secos. **Primera cita para Alicante.**

Atrichum undulatum (Hedw.) P. Beauv.

Almería: Sierra de Los Filabres, Barranco del Negro (Gérgal), WG3922, 1650 m. Hueco de roca esquistosa muy protegido. **Primera cita para Almería.** En el sudeste solamente se conocía de la provincia de Albacete (Jiménez *et al.* 1986).

Crossidium seriatum Crum & Steere

Alicante: Cerro de la Sal (Pinoso), XH7150, 650 m. Suelo yesífero, en claro de matorral. Taxon recientemente citado como novedad para la flora europea (Cano *et al.* 1992), asociado a suelos yesíferos o margo-yesíferos. **Primera cita para Alicante.**

Cynodontium bruntonii (Sm.) B., S. & G.

Almería: Sierra de Los Filabres, Arroyo de la Verruga (Gérgal), WG3619, 1800 m; Sierra de Los Filabres, Barranco del Pino (Bacares), WG 4221, 1850 m. En oquedades de rocas metamórficas casi sin suelo y taludes en bordes de arroyos. Aunque es relativamente común en la Península Ibérica, es una **nueva cita para el sudeste.**

Ditrichum cylindricum (Hedw.) Grout

Almería: Sierra de Los Filabres, Barranco del Maguillo (Bacares), WG4122, 1700 m. Tierra humífera desarrollada sobre esquistos, temporalmente inundada por agua de deshielo. **Nueva cita para el sudeste español.**

Entosthodon attenuatus (Dicks.) Bryhn

Alicante: Lagunas de Santa Pola, carretera Elche-Guardamar del Segura, km 9 (Elche), YH0428, 0 m. Suelo salino bajo *Artrocnemum fruticosum*. **Primera cita para Alicante.**

Ephemerum recurvifolium (Dicks.) Boul.

Alicante: Carretera Bolulla-Tárbena, km 34 (Tárbena), YH5386, 450 m; Coll de Rates (Alcalalí), YH5690, 600 m. En suelos básicos quemados. **No había sido citada** hasta ahora **en Alicante.** En el sudeste solamente se conoce de Almería (Acuña *et al.* 1974; Sérgio 1982 y Guerra *et al.* 1992a).

Fabronia pusilla Raddi

Alicante: Sierra de Menechaor, Santuario de la Font Rotja (Alcoy), YH1482, 1050 m (epífita sobre *Quercus rotundifolia*). Almería: Sierra de Los Filabres, Barranco de Cano (Gérgal), WG3721, 1700 m; Sierra de Los Filabres, Arroyo de la Verruga (Gérgal), WG3619, 1800 m (sobre rocas metamórficas y fondo de oquedades de éstas). Aunque citada en Murcia (Ros & Llimona 1984) y en Albacete (Heras & Ros 1986) es la **primera vez** que se recolecta en las provincias de **Alicante y Almería.**

Grimmia trichophylla Grev. var. ***meridionalis*** Schimp.

Almería: Barranco de Huelí, proximidades al Cortijo de la Fuente (Sorbas), WG7903, 475 m. Paredes de yeso sacaroideo con restos de polvo yesífero compactado. Citada anteriomente en Albacete (Heras *et al.* 1989), es **novedad para la provincia de Almería.**

Phascum cuynetii Biz. & Pierrot

Alicante: Salinas El Saladar (Calpe), BC4481, 0 m. Suelo nitrificado en un saladar. Especie conocida de la localidad tipo en el Cabo de La Nao (Alicante) (Bizot *et al.* 1970) y de la provincia de Almería (Martínez-Sánchez *et al.* 1991). Por el momento puede considerarse un endemismo del sudeste ibérico.

Philonotis calcarea (B. & S.) Schimp.

Almería: Sierra de Los Filabres, Barranco del Negro (Gérgal), WG3922, 1650 m. En taludes esquistosos húmedos por agua de deshielo. Es **nueva cita para Almería**, era conocida anteriormente de la provincia de Albacete (Jiménez *et al.* 1986).

Philonotis tomentella Mol.

Almería: Sierra de Los Filabres, Barranco del Negro (Gérgal), WG3922, 1650 m. Suelo esquistoso, humífero y muy húmedo, protegido por herbáceas. **Nueva cita para el sudeste español.**

Plagiothecium succulentum (Wils.) Lindb.

Almería: Sierra de Los Filabres, Arroyo de la Verruga (Gérgal), WG3619, 1800 m. Fondo de una fisura de roca metamórfica sin tierra. Hasta ahora **no era conocida del sudeste peninsular.**

Polytrichum juniperinum Hedw.

Almería: Sierra de Los Filabres, Barranco del Negro (Gérgal), WG3922, 1650 m. Tierra acumulada en fisura de roca esquistosa. Las únicas citas conocidas hasta el momento en el sudeste son las de Albacete (Heras & Ros 1986, Jiménez *et al.* 1986 y Heras *et al.* 1990), por lo que **se amplía su distribución a la provincia de Almería.**

Pottia recta (With.) Mitt.

Alicante: Salinas El Saladar (Calpe), BC4481, 0 m. Suelo nitrificado en un saladar. Se trata del **primer hallazgo de esta especie en el sudeste peninsular**.

Pottia wilsonii (Hook.) B. & S.

Almería: Sierra de Los Filabres, Barranco del Moratón. Mariviñas (Senés), WG6117, 1000 m. Talud húmedo en la base de roca metamórfica. Es la **primera vez que se cita en Almería**, aunque también se conoce de Alicante (Casas *et al.* 1984).

Schistidium flaccidum (De Not.) Ochyra

Almería: Sierra de Los Filabres, Barranco del Negro (Gérgal), WG3922, 1650 m; Sierra de Los Filabres, Arroyo de la Verruga (Gérgal), WG3619, 1800 m. Rocas esquistosas próximas a un curso de agua. **Nueva cita para el sudeste español**.

Timmiella barbuloides (Brid.) Mönk.

Alicante: Carretera Jalón-Bernia, km 7 (Jalón), YH5687, 500 m; Sierra de Orihuela (Orihuela), XH7218, 250 m. En suelos calizos protegidos. **Es una nueva cita para la provincia de Alicante**.

Tortula baetica (Casas & Oliva) Guerra & Ros

Alicante: Fuentes del río Algar (Callosa de Ensarriá), YH5283, 250 m; Sierra de la Escalona, subida pico Alcor (Orihuela), XH8302, 250 m. En rocas calizas y muros

artificiales. Descrita como variedad de *Tortula muralis*, es reconocida actualmente como especie (Guerra *et al.* 1992b). **Primera cita para la provincia de Alicante.**

Trichostomopsis aaronis (Lor.) Agnew & Towsend

Alicante: Sierra de Mariola, Santuario Virgen de Agrés (Agrés), YH1594, 770 m; Sierra de Orihuela (Orihuela), XH7218, 250 m; Sierra de Callosa, Barranco de Enmedio (Callosa de Segura), XH8421, 250 m. Suelos básicos descubiertos. **Es una nueva cita para Alicante.**

HEPATICAS

Athalamia hyalina (Sommerf.) Hatt.

Alicante: Sierra de Mariola, proximidades a las antenas de radio (Agrés), YH1694, 1200 m. Hueco de roca caliza con protosuelo. Es la **primera vez** que se **recolecta en Alicante**. En el sudeste español sólo se conocía en Albacete (Jiménez *et al.* 1986 y Heras *et al.* 1989).

Metzgeria furcata (L.) Dum.

Almería: Sierra de Los Filabres, Arroyo de la Verruga (Gérgal), WG3619, 1800 m. Pared de roca metamórfica poco iluminada. Citada en Albacete (Jiménez *et al.* 1986), es **novedad para Almería.**

Riccia glauca L.

Almería: Sierra de Los Filabres, Barranco del Negro (Gérgal) WG3922, 1650 m. En hueco de roca esquistosa y taludes humíferos. Es la **primera vez** que **se recolecta en Almería**, aunque ha sido citada en Alicante (Barnola, 1914).

Riccia sommieri Levier

Almería: Sierra de Los Filabres, Alto de la Molina, carretera de Senés a Tabernas, km 2 (Senés), WG5917, 1000 m. Talud en base de roca esquistosa protegido por herbáceas. **No se conocía en el sudeste español.**

Scapania calcicola (H. Arn & J. Perss.) Ingham

Alicante: Sierra de Mariola, proximidades a las antenas de radio (Agrés), YH1694, 1200 m. Oquedad de roca caliza con protosuelo. Se trata de la **primera cita en el sudeste peninsular.**

AGRADECIMIENTOS - Al Dr. Greven (Wageningen) por la revisión de las muestras del género *Grimmia*. A los Drs. J. Guerra y R.M. Ros por su ayuda en la determinación de especies conflictivas. Este trabajo es parte de los resultados del proyecto de investigación PB90-030-C02-01, subvencionado por la DGICYT de España.

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Source : MNHN, Paris

UN EXEMPLAIRE INHABITUEL DU PREMIER MÉMOIRE DU "*TENTAMEN METHODI MUSCORUM*" DE GREVILLE & ARNOTT

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RÉSUMÉ. - Titre, faux-titre, collation et pagination inhabituels pour le premier mémoire du "*Tentamen methodi muscorum*" de Greville & Arnott.

ABSTRACT. - Unusual title, half title, collation, pagination for first part of a separate of "*Tentamen methodi muscorum*" by Greville & Arnott.

Mots-clés. - Bibliographie, Greville & Arnott, Tentamen.

R.K. GREVILLE et G.A.W. ARNOTT ont publié une série inachevée de trois mémoires intitulée "*[Tentamen methodi muscorum; or,] a new arrangement of the genera of mosses ...*" dans la revue "*Memoirs of the Wernerian natural history society*" de 1822 à 1826. Des tirages-à-part ont été distribués plus tôt, en pré-publication; certains l'auraient été par Greville, avec la pagination de la revue; d'autres par Arnott, avec une nouvelle pagination continue. Ces articles posent divers problèmes bibliographiques (Margadant 1968: 134).

Pour le premier mémoire en tirage-à-part "d'Arnott", Margadant (1968) donne la collation (et pagination) suivante: "Π^1 A^2 B-C^8 D-E^2 (-E_2); i-iv [1] 2-42". Stafleu *et al.* (1976) écrivent: "i-iv, 1-42".

La bibliothèque Moretus Plantin à Namur possède un fascicule d'un tirage-à-part du premier mémoire dont le faux-titre, le titre, la collation et la pagination ne correspondent pas entièrement aux descriptions de Margadant ni à celles de Stafleu *et al.*

Ce fascicule est un exemplaire ouvert, mais non coupé; la planche est non coupée. Une reliure erronée très lâche montre facilement les cahiers. Une couverture de papier bleu est sans indications imprimées, mais porte, manuscrit "M. Achille Richard.".

Pagination : [i-ii] [1] 2-42; 1 pl. numérotée VII.
Collation : E_2 A^2 B-C^8 D^2 E_2 {cahier E retourné !}.

Contenu : [i] "A | NEW ARRANGEMENT | OF THE | GENERA OF MOSSES, | WITH | CHARACTERS, | AND | OBSERVATIONS ON THEIR DISTRIBUTION, HISTORY, | AND STRUCTURE." {en haut de la page, manuscrit de la même écriture que sur la couverture :} "M. Achille Richard, | Des Auteurs."; [ii] {blanc}; [1]: "{barre double complète} | *A New Arrangement of the Genera of Mosses,* | *with Characters, and Observations on their* | *Distribution, History, and Structure.* | {très courte barre double} | By R.K. Greville, Esq. F.R.S.E. M.W.S. &c., | AND | G. A. Walker Arnott, Esq. A.M.F.R.S.E. | {très courte barre enflée} | Memoir I." | {puis début du texte: 11 lignes}; 2-20, 27-28, 25-26, 23-24, 21-22, 35-36, 33-34, 31-32, 29-30, 37-42: {suite du texte}; Plate VII.

Les pages [i-ii] forment le deuxième feuillet, E^2, du cahier E retourné. Margadant dit ce deuxième feuillet manquant; ici, le cahier E de 2 feuilles avait donc successivement, avant pliage, les pages 41 {avec la signature; suite du texte}, 42 {fin du texte}, [i] {faux-titre}, [ii] {blanc}.

Pour le fascicule complet on a donc successivement: E_2 {pages [i-ii]} A^2 {pages [1] 2-4} B^8 {pages 5-20} C^8 {pages 27-30 dans l'ordre indiqué plus haut; la signature C est bien sur la page 21 et C^2 sur la page 23} D^2 {pages 37-40} E_1 {pages 41-42}.

Les cahiers ont été ouverts avant reliure; le relieur a inversé l'ordre des 4 doubles feuillets (feuillets conjugués) du cahier C.

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ANALYSES BIBLIOGRAPHIQUES

D. LAMY

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TEWARI S.D. and PANT G.B. - **Bryophytes of Kumaun Himalaya**. Dehra Dun: Bishen Singh Mahendra Pal Singh, 1994, [i]-xi, [1]-240, ill. (Aut. : Dept. Bot., D.S. B. College, Kumaun Univ., Naini Tal, India; éd.: 23-A, Connaught Place, Dehra Dun, 248001 India, ISBN 81-211-0093-3).

Après avoir donné des informations sur l'histoire des récoltes bryologiques dans la région du Kumaun Himalaya, sur la géographie, la géologie, le climat des sites et la méthodologie suivie, les auteurs étudient les divers habitats avec les associations bryophytiques du district de Nainital, et les communautés bryophytiques associées à l'enrichissement minéral du substrat dans la région du Kumaun Himalaya. 39 genres et 67 espèces d'hépatiques, 106 genres et 184 espèces de mousses sont citées. 3 appendices complètent le texte: habitat préférentiel de la bryoflore; répartition des bryophytes épiphytes de 9 plantes hôtes; bryophytes épiphytes du *Pinus roxburghii* à différentes altitudes. Sont nouveaux pour l'Inde: *Campylopodiella ditrichoides, Syrrhopodon spiculosus* var. *horridulus, Pseudosymblepharis subduriuscula, P. angustata, Barbula subcontorta, Grimmia pulvinata, Pohlia crudoides, Meteoriopsis formosana, Thamnobryum latifolium, Distichophyllum schmidtii, Sematophyllum humile, Leiodontium gracile*. De nombreux taxons sont nouveaux pour le NW de l'Himalaya. Les auteurs ont porté leur attention sur les espèces menacées, pour lesquelles ils précisent la biologie et l'écologie: *Stephensoniella brevipedunculata, Sewardiella tuberifera, Athalamia pinguis, A. pusilla, Cryptomitrium himalayensis, Conocephalum conicum, Wiesnerella denudata, Ricciocarpos natans, Calycularia crispula, Metzgeria furcata*. Bibliographie pp. 211-240.

JOHANNSSON B. - **Islenskir mosar. Skaenumosaaett, kollmosaaett, snoppumosaaett, perlumosaaett, knappmosaaett, ogtoppmosaaett**. *Fjölrit Natturufnaedistofnunar* 1995, 26, 1-129, ill. (Natturugraedistofnun Islands, Hlammi 3, Postholf 5320, 125 Reykjavik, Islande).

Description (et clé aux genres et aux espèces), illustration, écologie et distribution des Mniaceae (6 *Mnium*, 1 *Plagiomnium*, 1 *Cyrtomnium*, 4 *Rhizomnium* et 2 *Cinclidium*), des Aulacomniaceae (2 *Aulacomnium*), des Meesiaceae (1 *Paludella*, 2 *Meesia* et 1 *Amblyodon*), des Catoscopiaceae (1 *Catoscopium*), des Bartramiaceae (1 *Plagiopus*, 2 *Bartramia*, 1 *Conostomum* et 6 *Philonotis*), et des Timmiaceae (4 *Timmia*), présentes en Islande.

EGEA J.M. and TORRENTE P. - **El genero de hongos liquenizados *Lecanactis* (Ascomycotina).** *Bibliotheca Lichenologica* 1994, 54: 1-205, 17 fig., 20 pl. (J. Cramer *in* Gebrüder Borntraeger Verl., D-70176 Stuttgart, ISBN 3-443-58033-5, prix: 110 DM).

La délimitation du genre *Lecanactis* sensu Zahlbruckner est revue à la lumière de son histoire, de sa morphologie et de son anatomie (thalle, ascoma, et pycnides), de l'ontogénie de son ascoma, de sa chimie, de son écologie et de sa phytogéographie. Dans les Arthoniales, l'excipulum de type lécidéoïde délimite un groupe naturel comprenant: *Opegrapha* Ach., *Lecanographa* Egea et Torrente, *Lecanactis* Koerb., *Cresponea* Egea et Torrente, *Bactrospora* Massal., *Ancistrospora* Thor,

Sagenidium Stirton, *Sipmania* Egea et Torrente, *Catarraphia* Massal. Chaque genre est délimité; des tableaux permettent de comparer leur morphologie, l'anatomie de leurs ascomas, leurs asques, leurs ascospores, ainsi que leur chimies et leurs écologies. Les centres d'origine et les modes possibles de migration de ces genres sont envisagés. Le genre *Lecanactis* s. str. se divise en deux groupes autour de *Lecanctis dilleniana* d'une part et de *Lecanactis abietina* d'autre part; le genre *Lecanoagrapha* se divise lui aussi en deux groupes: le groupe de *Lecanographa grumulosa* et le groupe de *Lecanographa lyncea*. Clés aux genres à excipulum lécidéoïde, aux *Lecanactis* et aux *Lecanographa*. Taxonomie, références à l'iconographie, description et illustration, chimie, distribution et habitat sont donnés pour chacune des espèces étudiées. Le genre *Lecanactis* s. str. comprend 24 taxons dont les espèces nouvelles: *Lecanactis exigua* (Nouvelle-Zélande), *L. latispora* (Tasmanie), *L. neozelandica* (Nouv. Zélande), *L. spermatospora* (Australie), *L. sulphurea* (Australie), *L. tibelliana* (Nouv.-Zélande). Le genre *Lecanographa* est un genre nouveau dont l'espèce type est *L. lyncea* (Sm.) comb. nov. (= *Lichen*), le nouveau genre comprend aussi: *L. abscondita* (Th. Fr.) (=*Opegrapha*), *L. aggregata* sp. nov. (Tasmanie), *L. amylacea* (Ehr. & Pers.) (=*Lichen*), *L. cretacea* (Müll. Agr.) (=*Opegrapha*), *L. daileuca* (Cromb.) (= *Opegrapha*), *L. dimelaenoides* (Egea & Torr.) (= *Lecanactis*), *L. farinosa* (Hepp) (= *Opegrapha*), *L. farinulenta* (Müll. Arg.) (=*Opegrapha*), *L. follmannii* (Dodge) (= *Opegrapha*), *L. grumulosa* (Duf.) (= *Opegrapha*), *L. hemisphaerica* (Laundon) (= *Lecanactis*), *L. hypothallina* (Zahlbr.) (= *Platygrapha*), *L. illecebrosula* (Müll. Arg.) (= *Opegrapha*), *L. lynceoides* (Müll. Arg.) (= *Opegrapha*), *L. microcarpella* (Müll. Arg.) (= *Opegrapha*), *L. occidentalis* sp. nov. (Chili), *L. subcaesia* (Malme) (= *Lecanactis*), *L. subcaesioides* sp. nov. (Uruguay), *L. subcalcarea* (Müll. Arg.) (= *Opegrapha*), *L. subdryophila* (Follm. & Vezda) (= *Lecanactis*), *L. subgrumulosa* (Egea *et al.*) (= *Lecanactis*), *L. unghvariensis* (Szatala) (= *Lecanactis*), *L. werneri* (Faurel *et al.*) (= *Opegrapha*).; *Sipmania* gen. nov., dont l'espèce type est *S. peltata* sp. nov. des Iles Fidji. Certains taxons ont une position incertaine, d'autres appartiennent à des genres déjà étudiés (genres *Ancistrospora, Bactrospora, Catarrhaphia, Cresponea, Opegrapha, Sagenidium*), d'autres sont exclus de l'étude. La bibliographie (6p.), l'index taxonomique (7p.), ainsi que le catalogue des espèces (espèces citées sous *Lecanactis* sl. l. avec indication de leur nom actuel) et la liste des nouveaux noms proposés rendent cette monographie très claire.

HINTEREGGER E. - **Krustenflechten auf den *Rhododendron*-Arten (*Rh. ferrugineum* und *Rh. hirsutum*) der Ostalpen unter besonderer Berücksichtigung einiger Arten der Gattung *Biatora*.** *Bibliotheca Lichenologica* 1994, 55: 1-346, 79 fig. (J. Cramer *in* Gebrüder Borntraeger Verl., D-70176 Stuttgart, ISBN 3-443-58034-3, prix: 212.50 DM).

La flore lichénique de *Rhododendron ferrugineum* L. et *R. hirsutum* L., dans les Alpes orientales (quelques espèces des Alpes occidentales) est étudiée sur la base de 2000 spécimens (herbier et récoltes de l'auteur); 118 esp., 5 var. et 2 formes appartenant à 42 genres ont été identifiées; clés pour identifier ces lichens crustacés (à discopcarpe, avec des apothécies plus ou moins lirelliformes, avec des périthèces, stériles). Nouveaux taxons: *Acrocardoa gemmata* var. *rhododendri* var. nov. (Slovénie), *Biatora porphyroplaca* Hintereg. & Poelt (Autriche), *Rinodina ventricosa* Hintereg. & Giralt (Autriche), *Biatora flavopunctata* (Tonsberg) Hintereg. & Printzen c.n. (=*Lecanora*), *Biatora subgilva* (Arnold) c.n. (= *B. vernalis* var.) et *Lecidea betulicola* f. *endamylea* (Hedl.) (=*L. plusiospora* var.). L' auteur met en évidence une faible spécificité des lichens vis-à-vis du substrat; seuls *Biatora leprosula, B. rhododendri* et *B. sugilva* sont spécifiques de *Rhododendron*, tandis que *Biatora flavopunctata, Caloplaca sorocarpa, Lecanora boligera, L. fuscescens, L. gisleri* et *L. salicicola* ne montrent qu'une simple préférence pour ce substrat. *Rh. ferrugineum* est plus généralement colonisé que *R. hirsutum*. Ces lichens crustacés se distribuent selon des éléments phytogéographiques différents. 23 des taxons sur *Rhododendron* sont des taxons saxicoles (la plus part silicicoles), se déplaçant de la pierre vers *Rhododendron* sous des conditions optimales. Le

traitement taxonomique comprend pour chaque genre une clé si nécessaire, pour chaque taxon: morphologie, anatomie, chimie, distribution géographique, variation. Une attention particulière est donnée à 9 espèces du genre *Biatora* s.str., et *Biatora* s.l. (divisé en 3 groupes: *leprosula, rhododendri* et *pullata*). Bibliographie (25 p.), index des esp. (9 p.)

DIEKMANN M. - **Deciduous forest vegetation in boreo-nemoral Scandinavia**. *Acta Phytogeographica Suecica* 1994, 50: 1-116, 39 fig., 35 tabl. (Svenska Växtgeografiska Sällskapet, Villavägen 14, S-752 36 Uppsala, ISBN 91-7210-080-X, prix: 290SEK).

L'étude porte sur les forêts caducifoliées du S et SE de la Norvège, 369 relevés ont été traités par des méthodes numériques. Il en ressort la définition de 4 types de forêts et de 9 communautés: 1. forêts de chênes oligotrophes (communautés à *Quercus petraea-Frangula alnus*, et à *Quercus robur-Betula pendula*); 2. forêts caducifoliées mixtes mésotrophes (communautés à *Q. robur-Tilia cordata*, à *Q. robur-Euonymus europaeus*, à *Q. robur-Fraxinus excelsior*); 3. forêts d'aulnes et de frênes eutrophes (communautés à *Ulmus glabra-Fraxinus excelsior*, à *Ulmus minor-Fraxinus excelsior*); 4. forêts de frênes-pruniers eutrophes (communautés à *Fraxinus excelsior-Prunus padus*, à *Fr. excelsior-Alnus glutinosa*). Les forêts mésotrophes représentent le type de forêt le plus répandu et le plus caractéristique de la zone boréo-némorale, avec des contreparties floristiquement semblables dans la zone némorale. L'auteur donne pour chaque communauté: la composition en espèce, la structure, la différentaition, la distribution géographique, les conditions écologiques, la dynamique ainsi que les affinités avec d'autres communautés des zones de végétation de l'Europe du Nord et du Centre. L'auteur note d'une part que les facteurs de l'environnement, au niveau des types de forêts, est le statut nutritionnel en liaison avec les variations de conditions lumineuses et du gradient d'humidité; d'autre part qu'au niveau des communautés, les facteurs géographiques et climatiques et le gradient d'humidité jouent un rôle important. Ces forêts de bois dur sont en danger en Scandinavie; il faut notamment protéger les types eutrophes. Bryophytes associées.

SERGIO C., CASAS C., BRUGUES M. & CROS R.M. - **Lista vermelha dos briófitos da Peninsula Ibérica - Red list of bryophytes of the Iberian Pensinsula**. Lisboa: Instituto de Conservação da Natureza & Museu, Laboratório e Jardim Botanico, Universidade de Lisboa. 1994, 45p., 6 pl., 19 fig., en portugais et en anglais (ISBN 972-8083-30-0).

A partir des données bibliographiques, des données d'herbier et des données récentes, les auteurs ont pu établir une liste des bryophytes menacées dans la Péninsule ibérique (critères IUCN), avec une évaluation des habitats comprenant un très grand nombre d'espèces menacées, et les tendances phytogéographiques des espèces les plus vulnérables. Les espèces rares sont à dominance boréale, océanique et océanique-méditerranéenne. Sur un total de 1044 espèces, 399 sont considérées rares ou menacées: 10 sont éteintes, 38 menacées, 70 vulnérables, et 281 rares. Il est nécessaire de protéger certains habitats. 9 des 26 espèces à protéger selon la Convention de Berne sont présentes dans la Péninsule Ibérique.

FREY W., FRAHM J.P., FISCHER E. & LOBIN W. - **Die Moos- und Farnpflanzen Europas**. 6. Aufl. Kleine Kryptogamenflora Bd. IV. Stuttgart, Jena, New York: Gustav Fischer Verlag, 1995, XII, 426p., 149 fig. (Postfach 720143, D-70577 Stuttgart, ISBN 3-437-30756-8, prix: 78 DM).

Cette flore des bryophytes et des fougères d'Europe se présente comme une clé illustrée des taxons. Clés aux bryophytes/ptéridophytes. Pour les bryophytes, clés aux groupes de rang supérieur

selon le sporophyte et selon le gamétophyte, puis clés conduisant aux espèces, sous-espèces et variétés dans chaque classe et sous classe: Anthoceropsida, Marchantiopsida (sous-classes Sphaerocarpidae, Marchantiideae, Metzgeriidae, Jungermanniidae), Bryopsida (sous-classes Sphagnidae, Andreaeidae, Bryoidae (clés aux ordres et familles). A ces clés sont ajoutés la bibliographie concernant les flores régionales, les catalogues floristiques, les listes rouges. Les ptéridophytes sont organisées de la même façon. Un lexique (pp. 394-399) et un index des taxons (pp. 401-426) complètent cette « flore » d'un format pratique et bien illustrée.

SJÖGREN E. - **Changes in the epilithic and epiphytic moss cover in two deciduous forest areas on the island of Öland (Sweden) - a comparison between 1958-1962 and 1988-1990**. *Studies in Plant Ecology* 1995, 19: 1-106, 22 tabl., graph., 48 fig. (Svenska Växtgeografiska Sällskapet, Villavägen 14, S-75236 Uppsala, ISBN 91-7210-819-3, prix: 200SEK).

Le but de l'étude est de suivre la conséquence des effets accumulés de dépôts dûs aux pluies acides, entraînant un pH très bas des substrats occupés par les bryophytes, dans une forêt de chênes et de bouleaux (prélévement sur 116 bases de troncs de *Quercus robur*) et dans une forêt de d'ormes et de frênes (suivi de 143 rochers calcaires). L'auteur a noté pour chaque habitat: le changement ou la constance dans la présence des bryophytes, leur recouvrement, la fréquence des rochers ou troncs occupés, le nombre de colonies de chaque espèce, la sociologie et la diversité des taxons, globalement ou individuellement, sur chaque tronc ou rocher. Les changements de la bryoflore sont évalués en relation avec l'acidification.

Il résulte de ces observations que le recouvrement total d'espèces épilithes ou épiphytes a très peu changé. Cependant le pourcentage d'espèces neutroclines/acidiclines varie de 2/1 à 1/1 dans le cas des épilithes, de 4/3 à 1/3 dans le cas des épiphytes. Par rapport à la fréquence de leur présence sur tronc ou rocher, les neutroclines sont devenues beaucoup plus rares et parsemées, tandis que les acidiclines et les espèces à large gradient ont augmenté considérablement. Parmi les espèces épilithes quelques neutroclines ont totalement disparu, et 5 acidiclines ont envahi le substrat; parmi les espèces épiphytes, 6 neutroclines ont disparu. Le nombre total de troncs occupés par 9 neutroclines épiphytes est passé de 217 en 1958 à 119 en 1988; la plaque a été modifiée, montrant une augmentation des espèces à haute capacité de compétition. Si la diversité des espèces présente sur les rochers n'a subi que peu de modification (38 espèces en 1962, 37 en 1988), celle des épiphytes est en légère baisse (37 en 1962, 27 en 1988). Sur le plan phytosociologique, il y a chez les épiphytes, une baisse du nombre des espèces différentielles de l'alliance neutrocline *Schistidio-Anomodontion*, tandis que le nombre des espèces différentielles de l'alliance acidicline *Grimmion hartmanii* augmente. Par la disparition d'espèces neutrophiles, l'alliance épiphyte *Isothecio-Velutinion* s'est agrandie. L'écologie et la dynamique des bryophytes épilithes et épiphytes est mise en évidence (*Peltigera canina* est le seul lichen cité).

L'auteur a sélectionné pour les prochaines études sur les changements de la bryoflore liés à l'acidification, un petit nombre d'espèces indicatrices qui doivent répondre aux critères suivants: avoir non seulement une distribution écologiquement étroite mais encore une large distribution géographique avec une forte compétitivité, c'est à dire des espèces remplaçant les espèces préférant un fort pH ou neutroclines qui s'en vont.

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